Smithsonian

January 1996

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Twenty years after: the new faces of a still-troubled country (p. 32)

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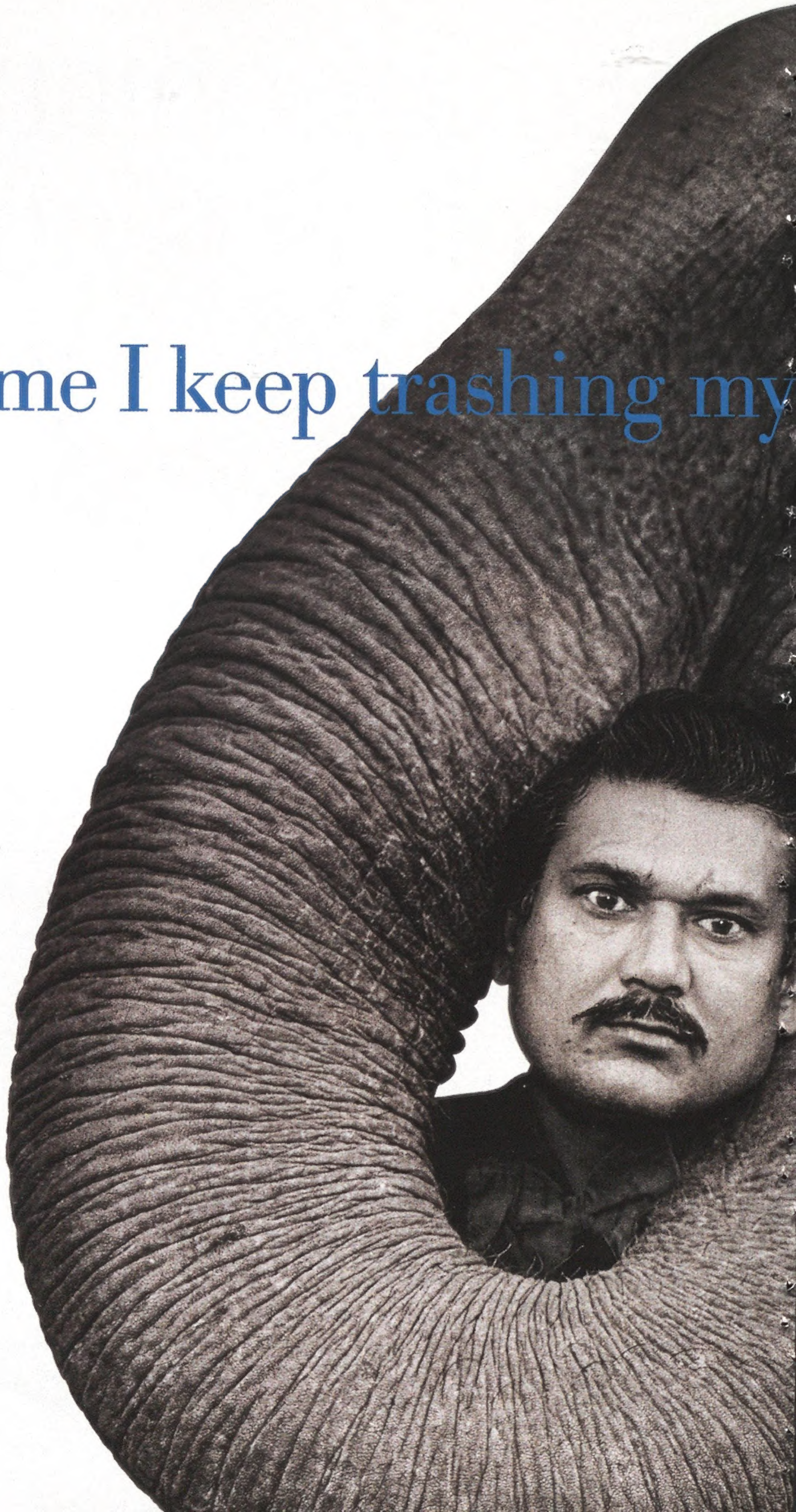

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Smithsonian *features*

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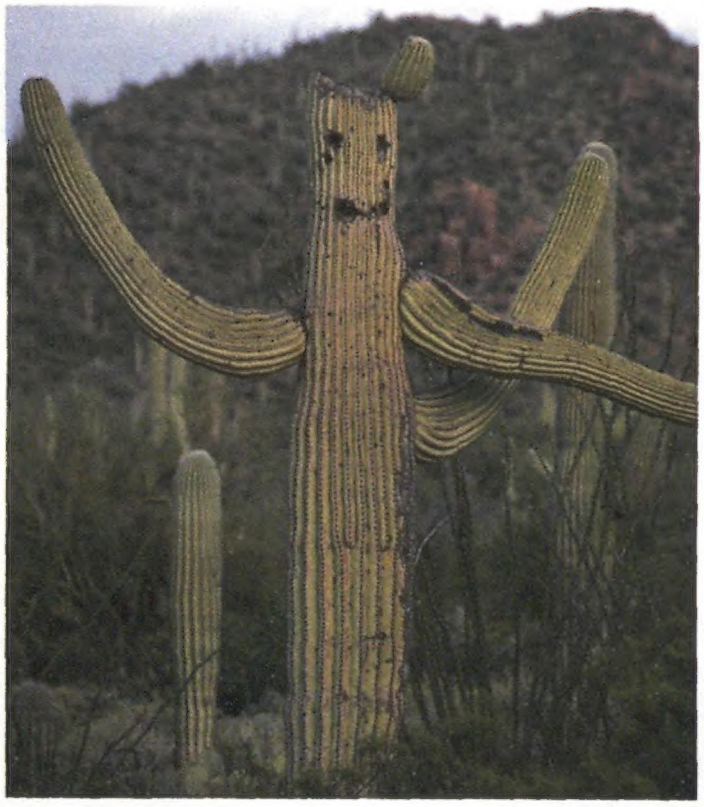

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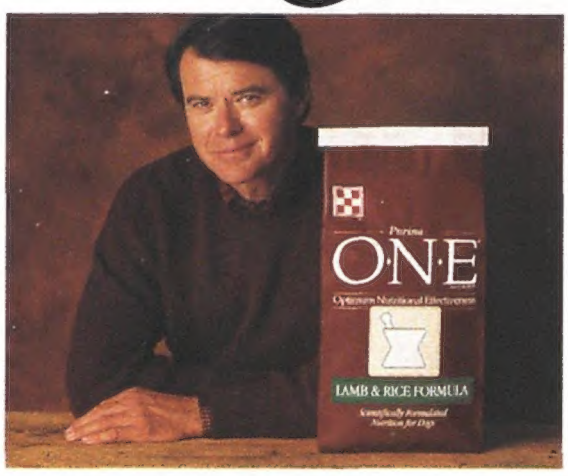
"It's Not Your Imagination. This Dog Food Could Actually Make A Dog More Handsome."



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Smithsonian *departments*

January 1996
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Cover

Cover:
At the Hanoi market, Ha Minh Thu, 24, pauses on her motorbike after buying flowers for her parents. From a poor family, Ha has opened a tiny shop, selling plastic housewares and earning $180 a month (p. 32)
Photograph by Catherine Karnow

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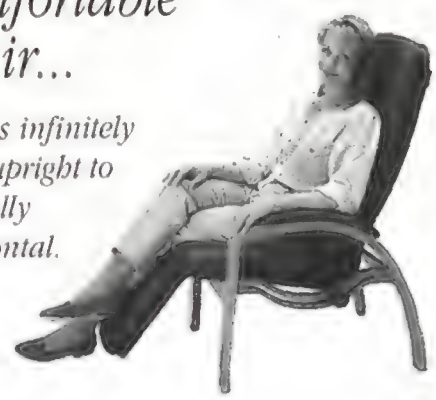

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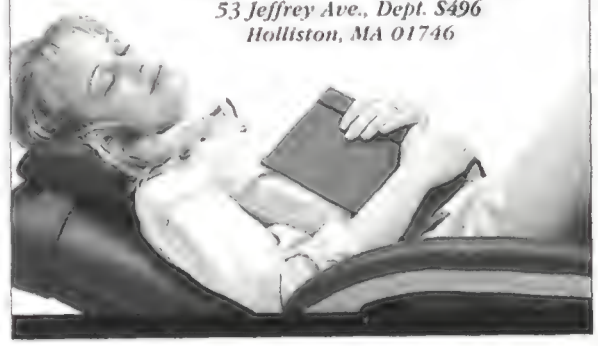

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Secretary Heyman's comments

Smithsonian Perspectives

It's our 150th anniversary, and we plan to celebrate all year long—by bringing the Smithsonian home to you

On New Year's Day 1996, the Smithsonian will officially launch its 150th-anniversary celebration in a special way. Hundreds of millions of television spectators of the 1996 Tournament of Roses parade will see the Smithsonian's unprecedented participation in this highly popular event. Our entry will highlight the most ambitious of all our anniversary activities, the centerpiece of our national outreach efforts: a traveling exhibition entitled "America's Smithsonian."

As I previewed for you in an earlier *Perspectives,* the national tour of this exhibition will open in Los Angeles on February 9. It will ultimately reach more than ten million people as it moves around the country over a two-year period. The 100,000-square-foot show will be booked into convention centers and will feature more than 300 treasures and national icons, most of which have never been away from their Smithsonian homes: First Ladies' gowns, Tecumseh's tomahawk, Arthur Ashe's tennis racquet, Auguste Rodin's *Walking Man,* the Apollo 14 command module, and hundreds more.

To finance this traveling exhibition—and to enable us to take it to the people of our country **without admission fees**—as well as to fund a yearlong program of promotion and information on the CBS television network, we have launched a "Corporate Partner Program." Our collaboration with CBS will result in "Smithsonian Minutes," which will be aired throughout the year, each featuring a little-known fact about the Institution and its collections. In addition, CBS will produce a one-hour special in January and a live broadcast of our 150th-birthday party from the Mall on August 10. The full cooperation of the corporate world in our 150th celebration will help us to reach our goal of national outreach and involvement.

Traveling in tandem with the exhibition will be an especially interesting program—"Voices of Discovery"—organized by the Smithsonian Associates. Through the "Voices" program, ten distinguished scholars will each spend five days in settings ranging from formal university- and museum-based lecture halls to television talk shows, elementary schools and civic-group meetings. These scholars will represent our effort to share the human and intellectual resources of the Institution concurrently with the physical resources to be featured in the traveling exhibition.

Several major new exhibitions will be held in 1996. For example, the National Portrait Gallery will open "1846" in April and "Red, Hot and Blue" in October. At the National Air and Space Museum, "How Things Fly" and "Cosmic Voyage" will attract millions of visitors. And the fully renovated Janet Hooker Hall of Geology, Gems and Minerals will reopen in the National Museum of Natural History in December.

SMITHSONIAN magazine will publish a special 150th-anniversary issue in May, and Smithsonian Books and Alfred A. Knopf have jointly published James Conaway's colorful history, *The Smithsonian: 150 Years of Adventure, Discovery, and Wonder.* An anniversary bell, the gift of the A. T. Cross Company (also founded in 1846), will be on public view in the Smithsonian Castle beginning in January. Cast at the Whitechapel Foundry in London, it will be hoisted into the Castle tower and will ring out for the first time on August 10.

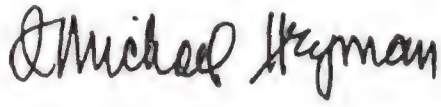
The Smithsonian National Board will travel (at their own expense) to England in the spring to hold an official meeting at James Smithson's alma mater, Pembroke College, Oxford University. In June, the Smithsonian Tropical Research Institute will host an international symposium to draw public and scholarly attention to the plight of coral reefs around the world.

In planning these and other celebratory activities, we paused to find out just how Americans look at the Smithsonian and what they expect of it. For instance, we discovered that the Smithsonian is really a personal experience; nearly half of all adult Americans say that they have visited one of our museums at some point in their lives. We also discovered that our name recognition is extraordinarily high, with more than 82 percent of all adult Americans having heard of the Smithsonian.

This kind of information validated our determination to foster an increased sense of "public ownership" of the Institution and make it more accessible to more people. We have tried, most of all, to be worthy of the deep affection for the Smithsonian that an overwhelming majority of Americans seem to feel.

I look forward to opening "America's Smithsonian" in each of its venues and to the "Members' Night" that will be held in each city during the exhibition. It will bring me great satisfaction to talk with our members and friends during the Smithsonian's 150th year and to hear from you directly if we have met our goals—and your expectations.

From all of us at the Smithsonian, Happy New Year; and to all of us—staff, members and friends—Happy Birthday!



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Letters to the Editor

An Editor's Note

Dear Sir: You did an interesting piece on the legendary Ed Thompson and his new book in the November issue.

Back about 1975, when I had been at *Washingtonian* for about five years and was having problems with the magazine's design, I saw Mr. Thompson at a Washington event. I knew he had done a great job at both *Life* and SMITHSONIAN, giving both magazines a clear visual direction.

So I introduced myself, told him about my design problems and asked his advice. He gave me a kind of Winston Churchill glare and was silent for what seemed like a full minute. Then he said, "When you notice the art direction, fire the art director," and walked away.

I've told the story to many art directors, and I think Mr. Thompson has made some of them more disciplined designers.

John A. Limpert, Editor
Washingtonian
Washington, D.C.

Soil scientist

Dear Sir: The illustration shown on page 104 of Richard Wolkomir's article is not, as the caption says, "an effective and poison-free method of chasing off predators, especially birds."

In 1952, as a professor at Iowa State University, I went to Guatemala to head a corn-improvement program. My immediate problem was parrots. I built a platform exactly as shown in your painting, hired an Indian to stand on it, gave him a basket of firecrackers, a slingshot and a package of cigarettes. The Indian lit the firecrackers from the cigarette and then shot them off at the parrots as they flew into my corn plots.

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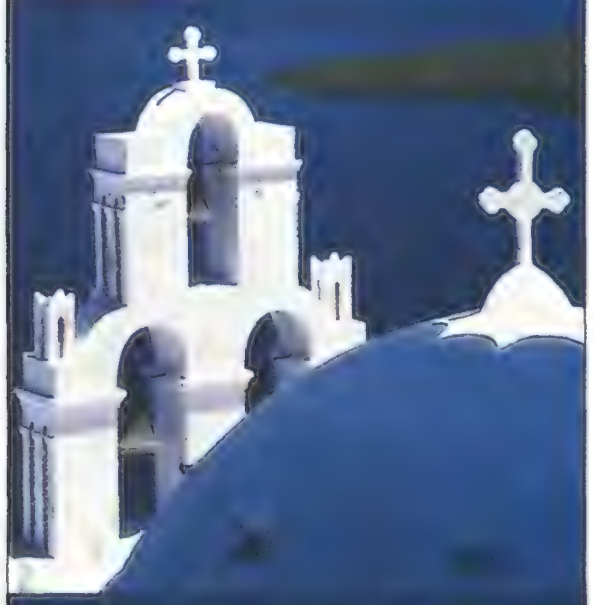

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The system worked for about two hours, and then the parrots adapted and seemed to enjoy the firecrackers as much as the Indian enjoyed his free cigarettes. After a few years of trial and error, the only permanent solution was to plant extra corn for the parrots and hope they would leave some for me.

Incidentally, the business office back at Iowa State wrote back on my expense account, "We don't reimburse for cigarettes and firecrackers."

William C. Paddock
Palm Beach, Florida

Risk: Part 1

Dear Sir: John F. Ross' article "RISK: Where do real dangers lie?" erroneously implies that the hazards of the pesticide Alar were overstated. Without scientific justification, critics still claim that the events that produced the public outcry were wrong, yet facts are stubborn things. Five separate studies between 1973 and 1984 linked Alar to tumors in animals. From 1987 to 1992, the Environmental Protection Agency conducted three reviews of Alar's carcinogenicity, finding in all cases that the chemical is a probable human carcinogen and that dietary exposure to the compound posed an "unreasonable" cancer risk.

Lawrie Mott
Al Meyerhoff
Natural Resources Defense Council
San Francisco

A breakdown product of Alar has been shown to be carcinogenic in rodents—at extremely large doses. A blue-ribbon United Nations study group has found any threat so minuscule, however, that it recommended allowing a daily intake of 0.5 milligrams per kilogram of body weight. In the 1980s, when Alar was still being used, the average U.S. citizen's exposure was 0.000047 milligrams per kilogram. Ed.

Dear Sir: Your article is based on the assumption that if we continue to do what we are doing, but do it in the order of real priorities, we will be better off. That seems reasonable, but it does have drawbacks.

Take, for example, the bit about the risks involved in driving small cars: "While common sense dictates that a larger car is safer to drive, the numbers tell us how much: overall, you are 17 times more likely to die in a head-on crash if you're driving a small vehicle." The laws of physics being what they are,

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common sense also tells us that if we all drive smaller cars, we will be a lot safer than if we all drive bigger cars. The article assumes that we are doomed to continue using roads already used not only by bigger cars but also by 18-wheeled behemoths.
Frank V. Holan
Westminster, Vermont

Dear Sir: Asbestos has repeatedly been shown in clinical and epidemiological studies to cause lung cancer, malignant mesothelioma, cancer of the larynx, cancers of the gastrointestinal tract and asbestosis. All of these diseases have a high mortality rate, and their causal association with asbestos has been recognized for nearly 50 years. The death toll from asbestos is fearsome. Studies undertaken at the Mount Sinai School of Medicine and at the Yale University School of Organization and Management indicate that each year in this country more than 8,000 deaths from asbestos-related cancer occur among the 30 million people who were exposed to asbestos in construction, shipbuilding, demolition, and in the manufacturing of asbestos products.

Additional asbestos cancer deaths occur in the wives and grown children of asbestos workers whose only exposure was as innocent bystanders. Because many of the cancers caused by asbestos appear only decades after exposure, this epidemic will extend well into the next century; the total mortality will exceed 200,000 deaths. Moreover, this total will likely be increased further by recent asbestos exposures in the demolition and renovation industries.
Philip J. Landrigan, M.D.
Mount Sinai Medical Center
New York City
Dr. Landrigan, who coauthored Raising Children Toxic-Free *with Herbert L. Needleman, M.D., is correct. The sentence in our article referred to the death rate among people in the general population, not among those whose occupations put them in continual contact with asbestos.* Ed.

Dear Sir: The article by John F. Ross is an outstanding piece of risk communication and should be compulsory reading for Congress as it debates risk-reform legislation. As a risk-assessment professional for 17 years, I have struggled to make the same points Ross made so eloquently.
Robert D. Vashon
Cleves, Ohio

Phenomena, Comment and Notes

Dear Sir: I have just read Marie Winn's wonderful column about the red-tailed hawks nesting on Fifth Avenue. I, too, reside in New York City, and for some years I have kept a bird feeder and a plate of sunflower seeds on my fire escape. I attract mainly finches, doves and sparrows with the occasional blue jay and tufted titmouse passing through.

Since last spring I have counted ten "handicapped" birds visiting my feeder and plate. I have seen two female finches with only one eye, the other completely covered over by feathers. I have seen a blue jay with the top part of his beak missing. He used to turn his head from side to side, and he almost laid it down on the plate to scoop up seeds.

Two of the more interesting birds are male finches that I believe to be father and son. They have only short stumps for legs. To maintain balance, they have to flap their wings to right themselves. All of that additional wing work gives them a barrel-chested appearance.

They are all marvels of adaptation.
Karen Konicki
New York City

Pliny the Elder

Dear Sir: On page 157 you wrote, "Pliny's first book was *The Art of Using the Javelin on Horseback*, written while he was in the calvary in Germany." Had he not been an expert horseman, it may have appeared to be Calvary, but in reality, Pliny was in the cavalry.
Richard C. Paul
York, Pennsylvania

Elvis Presley

Dear Sir: Some years ago an intelligent student of mine asked, "Why is Elvis Presley an idol? He was a drug addict and he didn't have great talent." I told him I shared his wonder.

After reading Doug Stewart's article, I am more bewildered than ever.
Mary E. Hurd
Annapolis, Maryland

Dear Sir: The obsession that some people have with everything that is related to or associated with Elvis Presley is best described by a German proverb that goes: "Against human stupidity even the gods fight in vain."
Carlos G. Muñoz
New York City

19th-century Congressmen

Dear Sir: James R. Chiles' article on the bad old days of Congress was enjoyable yet sobering. You printed one error, however. Thomas Jefferson was not George Washington's Vice President but that of John Adams. Adams was Washington's Vice President and Jefferson was his Secretary of State.
Gene Torisky
Bowling Green, Ohio

Harmonicas

Dear Sir: You don't have to travel all the way to Trossingen, Germany, to see harmonicas. Currently on exhibit at the Smithsonian's National Museum of American History is "Small Wonder: The Harmonica in America." This is just a small portion of the Peter Kassan Collection of Harmonicas and Related Materials, which is one of the largest harmonica collections in the world and is housed at the Smithsonian Institution's Division of Cultural History.
Elizabeth McCullough Johnston
Acting Chair
NMAH, Division of Cultural History
Washington, D.C.

Dear Sir: I don't like to be picky, but the caption for the picture of Bob Dylan at the close of Rudolph Chelminski's article caught my eye. As to Dylan's being "one of the first to put his harmonica on a neck frame," please see the advertisement below from the 1902 Sears, Roebuck catalog.

I date back only to 1911 myself, but every one-man band I ever saw (whether or not I enjoyed the music!) included a neck-frame as standard equipment.
Rendall Bess
Dundee, Oregon
We should have said Dylan "popularized" the contraption. Ed.

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Smithsonian Highlights

Plan a Smithsonian Visit in 1996!

Join in the fun as the Smithsonian celebrates its 150th anniversary with a year-long schedule of special exhibitions and events. *Receive a free Associates' planning packet.* Write Smithsonian Information, Smithsonian Institution, Washington, D.C. 20560, or call (202) 357-2700 (voice) or (202) 357-1729 (TTY) daily, 9 A.M.- 4 P.M. *Note:* Parking near Smithsonian museums is limited. The Metrorail subway system, convenient to all museums, has parking available at some stations (details in packet).

Begin your visit at the Smithsonian Information Center's Associates' Reception Desk (open 9 A.M.- 4 P.M. daily) in the Castle, where special materials await you. The National Museum of Natural History's Court dining room offers Associates a discount on a buffet served daily from 11 A.M. to 3 P.M.

Museum Hours

Smithsonian museums are generally open 10 A.M.- 5:30 P.M. daily, except December 25. Hours at the National Zoo are 9 A.M.- 4:30 P.M. daily for buildings, and 8 A.M.- 6 P.M. for grounds.

Smithsonian Web Site

The Smithsonian home page on the World Wide Web (http://www.si.edu) offers on-line information about exhibitions, collections, products, events, and activities commemorating the Institution's 150th anniversary.

Smithsonian Musical Weekend

The 24th annual Smithsonian Musical Weekend will be held April 26-28. Highlights will include performances by the National Symphony Orchestra and the Smithsonian's Chamber Music Society, and dinner at the National Portrait Gallery. For information, call (202) 973-2162.

Small Street (1985) by Bui Xuan Phai is in SITES show of contemporary Vietnamese art at the Michener Museum in Doylestown, Pennsylvania, through February 18.

Special January Exhibits, Events

National Air and Space Museum

Africa: The Serengeti (6:15 P.M. daily) New film takes viewers on an Imax safari to the "last great place on Earth." See *Highlights Continued,* page 24.

Flights of Fancy: Photographs by Jacques-Henri Lartigue, 1904-1922 (through March 3) Images capture the early years of aviation.

The Enola Gay (runs indefinitely) Exhibition features the forward fuselage of the *Enola Gay,* the B-29 that dropped the atomic bomb on Hiroshima. For information, call (202) 786-2122.

National Museum of Natural History

Landscape Kimonos by Itchiku Kubota (through April 14) Japanese artist Itchiku Kubota revived an ancient pattern-dyeing technique to create a lyrical series of handcrafted kimonos.

Gem and Mineral Hall Gallery is closed for renovation until December 1996. The famous Hope Diamond is on view on the second floor of the Rotunda.

Giant Squids Permanent exhibit showcases the world's largest invertebrates.

National Zoological Park

Think Tank New permanent exhibition explores the biology and evolution of animal thinking, focusing on orangutans, monkeys, crabs, leaf-cutter ants.

National Museum of American History

Who's in Charge: Workers and Managers in the United States (January 18-April 7) Smithsonian Institution Traveling Exhibition Service show chronicles the battle between workers and managers for control of the workplace.

With Pen and Graver: Women Graphic Artists Before 1900 (through January 28) Photographs, prints, books, cards, plates and other graphics.

Science in American Life Permanent exhibition tracks advances and discoveries in science over the past 125 years and features a hands-on science center.

First Ladies: Political Role and Public Image Permanent installation looks at the various roles and public perceptions of our nation's First Ladies.

National Postal Museum

Located next to Union Station on Capitol Hill, the museum presents exhibitions that trace the history of the nation's mail service, from the Colonial Post and the Pony Express to the beauty and lore of stamps.

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Hirshhorn Museum & Sculpture Garden
Directions—Carmen Lomas Garza (through February 18) Works by the San Francisco-based artist offer powerful visual narratives of Mexican-American life.

Freer Gallery of Art
In Human Form: Images of the Secular and Divine in Chinese Painting (January 18-October) Exhibition of works dating from the 11th to 18th centuries examines how images of people shape and inform Chinese painting.
The Life of a Japanese Painting (through August 4) Exhibit of newly conserved paintings explores issues of repairing rare works on delicate silk or paper.

Arthur M. Sackler Gallery
Goyō: Japanese Prints (through March 17) Color woodblock prints by Japanese artist Hashiguchi Goyō were issued betwen 1915 and 1920.
Traders and Raiders on China's Northern Frontier (through September 2) Artifacts from the first millennium B.C.

National Museum of African Art
Three Explorations: Yoruba, Temne, and Baga (through February 26) Exhibit examines a Yoruba mask, a Temne female figure and a Baga ritual object.
Art from the Forge (through March 3) Jewelry, ceremonial armor and furnishings made by the Tuareg and Moor peoples of West and North Africa.

Arts and Industries Building
Equal Rights and Justice (through March 3) Exhibition presented by the Smithsonian's Center for African American History and Culture features contemporary art inspired by events in the civil-rights movement.
Discovery Theater
Pied Piper (January 7-19) *Silver Winged Wishes and the Golden Memory Box* (January 22-March 1) Live theater for young audiences. For information, call (202) 357-1500 (voice or TTY).

The Castle—Great Hall
Smithson's Gift (opens January 1) Display commemorating the Smithsonian's 150th anniversary tells the story of the British scientist whose bequest founded the Institution.

National Portrait Gallery
Rebels: Painters and Poets of the 1950s (January 26-June 2) Exhibit looks at the artists and writers of the Beat Generation and the New York School, including Jack Kerouac and Mark Rothko.

New York's Triborough Bridge is in the Cooper-Hewitt's "Six Bridges" exhibit.

Cecilia Beaux and the Art of Portraiture (through January 28) Major retrospective features the work of the turn-of-the-century portrait painter.

National Museum of American Art
Metropolitan Lives: The Ashcan Artists and their New York (through March 17) Works by such American artists as Robert Henri and John Sloan. For images and information, see show's World Wide Web site: http://www.nmaa.si.edu/metlives/ashcan.html.

Renwick Gallery
American Crafts: The Nation's Collection (runs indefinitely) Selection of 19th- and 20th-century pieces from the permanent collection by nationally prominent artists in a variety of craft media.

Anacostia Museum
Southern City, National Ambition: The Growth of Early Washington, D.C., 1800-1860 (through March 3) A joint presentation with the Octagon Museum, the exhibit includes artifacts, drawings and manuscripts from the city's early history. See *Around the Mall*, page 26.

Heye Center, National Museum of the American Indian (New York)
Creation's Journey: Masterworks of Native American Identity and Belief (runs indefinitely) First of three inaugural exhibits features objects selected for their rarity, beauty and historical significance.

Cooper-Hewitt, National Design Museum (New York)
Gallery Closing The exhibition galleries of the museum are closed to the public for renovation until September. Selected exhibits will be held off-premises during this period.
Six Bridges: The Making of the New York Megalopolis (January 25-April 19) Held at the PaineWebber Art Gallery, 1285 Avenue of the Americas, exhibit examines the impact of six major bridges erected between 1927 and 1964 (left).

Smithsonian on the Air

CBS News Special (January 25; 9 P.M. ET) One-hour prime-time special takes viewers on an adventure around the world with the Smithsonian. Celebrating the Institution's 150th anniversary, the broadcast spotlights cutting-edge research projects and expeditions sponsored by the museum complex.
Black Radio: Telling It Like It Was Premiere of Radio Smithsonian's 13-part documentary about radio and the 20th-century transformation of the African-American community, hosted by Lou Rawls. Check local public radio listings.

The Smithsonian Associates, Resident Program

To become a member, or for fee and ticket information, call (202) 357-3030. January events include:
James Smithson and His Legacy: The Early Years (January 21; 2 P.M.) Lecture celebrates the 150th anniversary of the Smithsonian Institution.
An Evening with Stephen Jay Gould (January 24; 6 P.M.) The renowned author lectures on evolutionary biology, zoology and the history of science.

Smithsonian Institution Traveling Exhibition Service

SITES organizes and circulates exhibitions to cities throughout the United States and abroad. To sponsor a show in your community, write SITES, Smithsonian, Washington, D.C. 20560. Here are some January exhibits:
• Doylestown, Pennsylvania (through February 18) *An Ocean Apart: Contemporary Vietnamese Art from the U.S. and Vietnam*, James E. Michener Museum.
• Williamsburg, Virginia (January 19-March 3) *Voyages and Visions: Nineteenth-Century European Images of the Middle East from the Victoria and Albert Museum*, Muscarelle Museum of Art.

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Chapter One

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Highlights Continued

Where the great herds run free

Darkening clouds scud across an endless expanse of plain. Thunder rips the silence, and the roar of pounding hooves fills the air. The dust is almost palpable. "There is a place on Earth where it is still the morning of life, and the great herds still run free." So begins the new Imax/Omnimax film *Africa: The Serengeti*, now on view at the National Air and Space Museum's Langley Theater. Eloquently framing the film's action, these images and words set the stage for the drama of life and death on the Serengeti plains of East Africa.

Refuge to the greatest concentration of wildlife on Earth, these vast grasslands harbor millions of diverse creatures. Elephants, lions, leopards, cheetahs, hyenas and hippos all abound; but the homely "clowns of the African plains," the ungainly-looking wildebeests, predominate. Each year, nearly 1.5 million strong, they embark on an epic journey in search of water and grass.

Pursued by predators, the herd makes its way from the short-grass plains of Tanzania in the south to the rich pastures of Kenya's Masai Mara National Game Reserve in the north. Battling savage fires and swollen rivers, the entourage skirts ancient outcroppings and the encampments of the proud Masai. Produced by Graphic Films Corporation and the Houston Museum of Natural Science, *Africa: The Serengeti* tracks this harrowing 500-mile odyssey, revealing the secrets of a unique ecosystem.
Diane M. Bolz

To confuse predators, zebras gather together in a puzzle of stripes; 200,000 join the annual wildebeest migration.

The 500-mile clockwise migration begins and ends in the wildebeests' calving grounds in the grassy plains of Tanzania.

Thundering herd of wildebeests pounds across the drought-stricken plains of the southern Serengeti en route north in search of water and grass.

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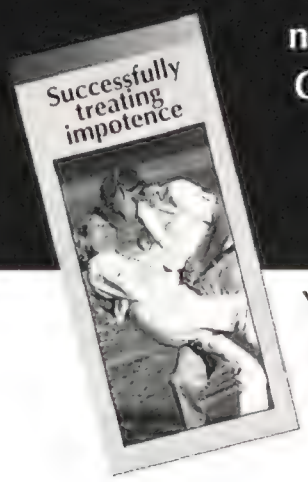

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Around the Mall and Beyond

By Michael Kernan

Since its founding in 1967, the Anacostia Museum has grown from 'storefront' concept to 'neighborhood museum' to world renown for innovative programs and service to the community

In 1857 work on the Capitol dome was under way, but Washington was still only the nation's 15th-largest city, its Pennsylvania Avenue a muddy field.

It is the kind of exhibit where you bend down over glass cases to study handwritten scrawls on old documents, the kind of modest, one-room exhibit that you think you'll tire of after about ten minutes. But then the poignancy of what's being told about in those scrawls hits you. The feelings stay with you long after you've left.

The show, at the Smithsonian's Anacostia Museum until March 3, offers a rare insight into the early days of Washington, D.C.—as it looked and felt before the Civil War, long before the time it would be called the "capital of the free world" (not to mention the "hive of bureaucrats"). The power of the show is in the stories about regular people—unremarked and unremembered.

From the records of the Washington Female Orphan Asylum, dated 1827: "Finding myself unabel to raise & educate my daughter Mary Ann I resign her intirely to the Managers of the Asylum untill she is 10 years of age." Signed, Elizabeth Baker.

Entitled "Southern City, National Ambition: the Growth of Early Washington, D.C. 1800-1860," the exhibit is cosponsored by the Octagon Museum (Octagon House, located two blocks west of the White House, was one of the city's first mansions), where a similar display on Washington's early days will also run through March 3.

The collections are amazing. At Anacostia there is a city directory of washerwomen, 102 of them, nearly all "col'd." There is a slave hire agreement from 1845, paying $75 for the hire of one Charles King for a year, "to be returned at Christmas next, well clothed with the customary clothes and furnished with a hat and blanket."

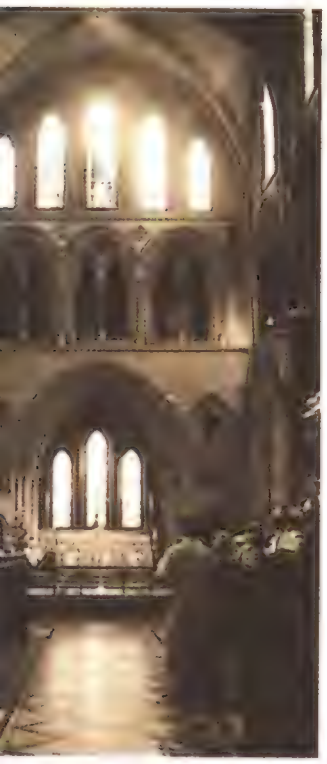
A photomural shows Pennsylvania Avenue in 1857, a wide, muddy field leading up to the partly built Capitol (left). Cowrie shells and beads, lovingly displayed, are all that remain of six female slaves who worked for the Tayloe family at Octagon House. There are purchase deeds and freedom certificates (which by law had to be carried at all times when in the South), a picture of a slave pen on G Street between Fourth and Sixth streets, a laconic note that slaves composed 20 percent of the city's population in 1800, 5 percent by 1850.

And on the other side of the tracks, so to speak, in the section of the exhibit titled "Power and Privilege," you see a humorous sketch of a party at Tudor Place in Georgetown in 1840, when it was the home of Mrs. Peters. A descendant of Martha Washington's, she was a society leader in her day. Other pictures show great houses owned by prominent white citizens.

But the emphasis of this show is on Washington's black community and its stories. An 1820 painting shows old Yarrow Mamout, a slave turned out by his master because he was too old. He lived on, beyond 100, working day wages and weaving baskets at night.

Stories: in 1810 Alethia Tanner purchased her freedom for $1,400 with extra money she made selling vegetables at Washington markets. Twenty-two years later, she manumitted her nephew, John Cook. He later established the 15th Street Presbyterian Church, one of the first churches in Washington for African-Americans, and became its founding pastor. There is a photograph of him here, a sturdy man with determined eyes.

In 1835 Cook fled the city after the Snow Riot, when whites attacked the store of merchant Beverly Snow for badmouthing them. Returning the next



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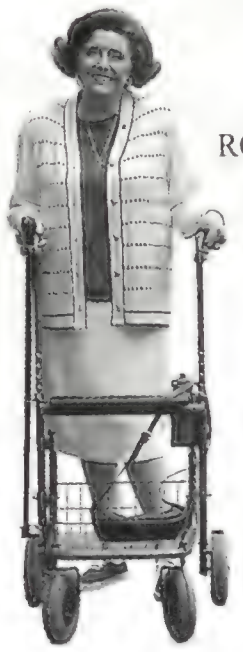

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year, Cook opened a school for black youths, and five years later he built his church. He died in 1856 at age 66. The stated purpose of this exhibit is to document "how in the shadow of the monumental public buildings that dominated its landscape, an urban community slowly took shape in the decades before the Civil War."

Certainly no example of such community growth could be more perfect than the Anacostia Museum itself, a bootstrap operation that has made museum critic Kenneth Hudson's list of the world's most influential museums ("museums which have broken ground in such an original or striking way that other museums have felt disposed or compelled to follow their example"), a list that has omitted the Louvre, the Getty and the National Gallery.

"We're about identity and community, about what makes living in Washington good," says Anacostia director Steven Newsome. "The current show focuses not only on the infrastructures such as the Chesapeake & Ohio Canal that made Washington an urban center, but on the people who built it."

Incidentally, slavery was abolished in Washington, with compensation to slaveholders, in 1862. By this time, the city markets were mostly run by free blacks, and in 1863 one of them, Columbus Scriber, opened a flour and feed store at 119 E Street Southwest.

"Actually, this is the second exhibit we've done on early Washington," says Newsome, who succeeded the founding director, John Kinard, in 1991. "Three years ago we did 'To Achieve These Rights,' depicting the self-determination of African-Americans in Washington from 1791 to 1992. We don't consider these exhibits so much black history as urban history in which black Americans are at the center."

The Anacostia Museum is located across the Anacostia River four miles from the National Mall. It is seen by relatively few tourists, and that's unfortunate, given its long history of fascinating exhibitions, such as "The Harlem Renaissance: Black Arts of the Twenties"; "Climbing Jacob's Ladder: The Rise of Black Churches in Eastern American Cities, 1740-1877"; and "The Real McCoy: African-American Invention and Innovation, 1619-1930."

The museum got its start in 1967 when then Smithsonian Secretary S. Dillon Ripley took note of the fact that a

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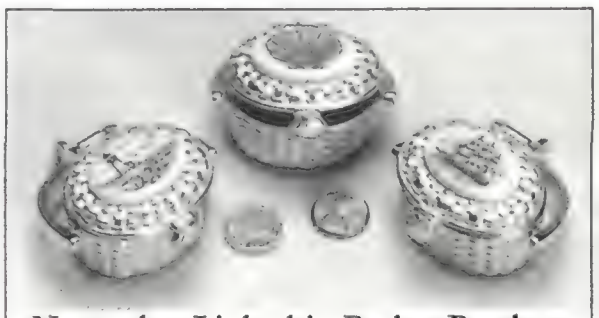

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large segment of Washington's population rarely if ever visited the imposing buildings on the Mall. He got the idea for a sort of storefront museum, a drop-in place without the fluted columns and grand staircases, an approachable place with hands-on exhibits. So he set the wheels turning.

What his people came up with was not a storefront but the old Carver Theater in the Southeast part of Washington, a former dance hall, skating rink and church with 5,000 square feet of space.

From day one, local citizens took a vital interest. A city-sponsored group called Teen Trailblazers worked alongside Smithsonian staff, and when the Anacostia Neighborhood Museum (as it was initially called) opened on September 15, 1967, with bands, speakers, cookies, punch and thousands of visitors, Ripley commented, "I suspect that museums will never be quite the same again."

Some saw a slight problem with the opening exhibit, which featured a full-scale mock-up of a Mercury space capsule, skeletons, a see-yourself TV setup, a small zoo and a reproduction of a country store. James Mayo, special assistant to director Kinard, observed that the museum "had absolutely nothing that came close to African-American history and culture," subject matter that was perhaps not quite the same as what Smithsonian curators in those days "thought about and what they dreamed about. They dreamed about spaceships and airplanes and trains and whistles—and whatever."

This situation was rectified without delay under the firm hand of John Kinard, great-grandson of a slave, whose credentials included the State Department, the United States Information Agency, Operation Crossroads Africa and pioneering work for the Southeast Neighborhood Development Program.

In his Office of Economic Opportunity days Kinard worked with youth organizations—such as Rebels With a Cause, the Band of Angels, the Neighborhood Youth Corps—and it was young people whom he enlisted to make the Anacostia Museum a source of urban vitality.

Kinard worked for hiring equity, for the training of minorities, for more-inclusive exhibits. To him, the "community" included the Nation of Islam, anti-methadone organizations, a group called the Inner Voices of Lorton Reformatory, bands and dance groups needing rehearsal space. Until the late '70s, there was even a parrot named George, who talked so much he had to be put in the restroom during meetings.

I don't remember George from my visits in those days, but I do remember going through an exhibit some years ago with Zora Martin-Felton, whom Kinard had hired at the outset to run the education program and who was by then assistant director and Kinard's good right arm. The show was a tribute to black women, and it was presented with such flair and imagination that it didn't need the gimmicks so often relied upon by wealthier museums.

Felton retired a year ago, but she made her mark. "African-American influences permeate every aspect of American life," she wrote in a coauthored 1993 tribute to Kinard. "The clothing we wear, the songs we sing, the dances we dance, the music we compose, the food we eat, the technology we use, the way we speak, the manner in which we style our hair, the high-five handshake, even the intense American love affair with a suntanned skin—all these attest to a deeply ingrained and powerful presence among us."

Over the years the museum expanded. The original building had many problems, and the area became drug-infested, so in 1985 the museum moved a mile up the hill to a site known as Fort Place.

Somewhere along the line the word "Neighborhood" was dropped from the name, for the museum's scope now reached far beyond the limits of Anacostia. For one thing, Kinard's own considerable travels in Africa resulted in lectures, lunchbox forums and special exhibits on international topics.

Of course, the dropping of the word had nothing to do with the museum's popularity. Attendance is well above 100,000 a year, including several school groups each weekday.

As Kinard, who died in 1989, once said, "This museum, if it is to survive, must [enmesh] itself more in this community in the future than it has in the past. . . . We cannot present a full diet of history and leave undone research on the urban problems that plague our community. . . . This museum, unlike any other museum anywhere on Earth, cannot be a place where we just show beautiful things and say pretty words about our history. It must be an advocate for a better way of life for the young and older people alike."

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Vietnam now

By Stanley Karnow

In the center of Saigon, streets glow with signs of new prosperity and trails of light from passing vehicles

Photographs by Catherine Karnow

Not long ago, I spent a couple of hours chatting with Gen. Vo Nguyen Giap, the celebrated Vietnamese military commander, as we sat amid the books and mementos that clutter his modest Hanoi villa. An elfin figure of 85, with hooded eyes, soft hands and silver hair, he is the man who crushed France's effort to reimpose its colonial presence in Vietnam and later doomed America's attempt to help its feckless South Vietnamese allies defend themselves against Ho Chi Minh's armies.

Giap once shared with Ho the deep-seated conviction that Communism alone held out the promise of progress. But now, stimulated by pragmatic economic policies, Vietnam has been more or less ardently embracing free enterprise, and General Giap is accommodating to the phenomenon.

From interviews with him years ago, I knew him to be unfazed by contentious questions. "What has happened to Marxism?" I asked, perhaps a bit aggressively. "Marx," he replied calmly in flawless French, "was a great analyst, but he never gave us a formula for running a country." I pushed a bit further. "And socialism? I was taught it meant state control of the means of production and distribution." Smiling faintly, the general said, "*Vous savez*, socialism is whatever brings happiness to the people."

Hitherto unknown homilies from Ho

The dream of an egalitarian paradise has similarly been scrapped by Communist propagandists. To conform to the new party line, they have dredged up one of Uncle Ho's hitherto unknown homilies: "The poor should get rich and the rich should get richer."

I reported on the war in Vietnam and have been back three times since it ended in April 1975. The war left the country in shambles, and the Communists aggravated the devastation following their victory. Encouraged by the Soviet Union, they squandered vast sums on industrial projects like steel mills rather than concentrating on agriculture and small factories. They suppressed private entrepreneurs and, by shunting peasants into collectives, sapped initiative and crippled farm production. They also interned as many as 300,000 vanquished South Vietnamese officials and army officers in brutal "reeducation" camps. Hundreds of thousands of "boat people" fled the country, stark evidence of repressive revenge as well as proof that the economy was breaking down.

But within a decade party bosses, recognizing that they had tarnished the reputation they gained by winning the war, desperately started economic reforms. Stimulated chiefly by free markets and the resilience and sheer hard work of the Vietnamese people, Vietnam has since enjoyed a spectacular and much publicized recovery. Boosters now predict that Vietnam is destined to catch up with South Korea, Taiwan, Hong Kong and Singapore, the dynamic "little tigers" of Asia. I went back recently to try to separate the hype from reality, and I found such optimism inflated—or at the very least dramatically premature. The United States has at last recognized the Vietnamese government and, yes, some cities are booming, but rural Vietnam, where four-fifths of the population lives, lags way behind. With a per capita income of $280, Vietnam ranks with Bangladesh as one of the world's most destitute countries. It may still face a perilous future.

The term "Market-Leninism," confected to describe China's system, could apply to Vietnam as well. Though it has finally eased up a bit on the economy, the Communist Party still needs to dilute its absolute political power. Communists tolerate some criticism as a political safety valve, and they make concessions especially to such perennially discontented groups as students. But the party forbids rival movements and censors the press even for trivial infractions; while I was there an editor was dismissed for publishing an article suggesting that

Well met in Hanoi, two General Motors executives have an open-air consultation in side-by-side pedicabs.

In Vietnam's capital, everybody wants to make a deal, but Communist regime applies controls erratically.

Ho Chi Minh had been married—a blemish on his image as a saintly ascetic. They allow the large Catholic minority free worship, but constantly harass a faction of Buddhists that helped the overthrow of the South Vietnamese government in 1963—and, they seem to fear, may threaten the party's power. Last August, despite protests by the United States and human rights groups, they indicted Thich Huyen Quang, the 77-year-old patriarch of the banned Unified Buddhist Church, for "sabotaging religious solidarity." At least six Buddhists have been imprisoned on that charge.

The party is also discredited by reports of widespread corruption and other abuses. In Vietnam, just as it did nearly everywhere, the demise of the Soviet Union cast a pall over Communism as viable. Nobody foresees the party's imminent collapse, but its rosters dwindle. Old activists retire or die. New temptations distract the young. "Ideology is irrelevant," a Western diplomat told me. "Only two things matter—how to make money and how to spend it."

In Ho Chi Minh City, still almost always called Saigon, vestiges of France's colonial *mission civilisatrice* include Catholic churches, a replica of the Paris Opéra, *café filtre*, the best *baguettes* east of Suez. But, as everyone has reported, the sprawling metropolis of five million people pulses with fresh vigor. Billboards advertise computers by Hewlett-Packard, electronic equipment by Sony and Samsung. Shops overflow with television sets, video recorders, stereo systems, cameras, jewelry, counterfeit Rolex and Piaget watches, and garments flaunting such logos as Lacoste and Ralph Lauren, smuggled in by sea from Thailand or by land from China. Stalls are stacked with Marlboros, Salems, Johnny Walker and Remy Martin. By law, transactions must be conducted in *dong*, the national currency, but the dollar is almighty. Even taxi meters click away in dollars. The streets are a swirl of cars, trucks, bicycles and, predominantly, motorbikes—some propelled at breakneck speed by teenage boys in jeans, with microskirted girlfriends clinging behind.

A slice to the right on party golf courses

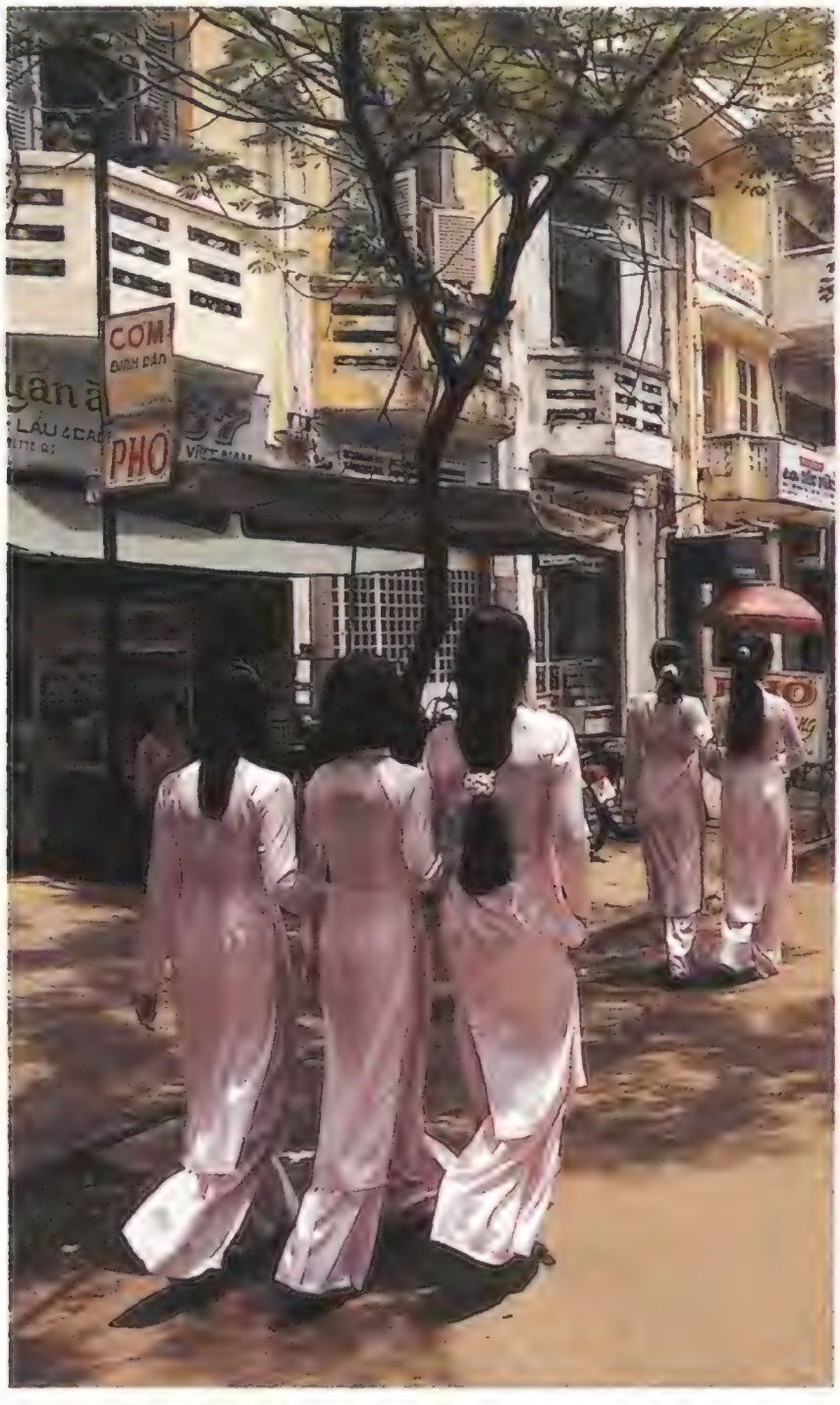
The Communist hierarchy has blessed that quintessentially bourgeois recreation—golf. A half-dozen courses now function around the country, one in the "iron triangle," a former Vietcong base ten miles north of Saigon. Complete with saunas and steam baths, it was constructed by a consortium of Japanese, Singapore, British and Swedish investors. The members, mostly representatives of foreign companies, pay $25,000 or more to join—a fee waived for Communist elites.

Luxurious hotels proliferate; elegant French relics have been refurbished, their rates matching those of New York, London and Tokyo. Out of nostalgia I returned to the Continental, which dates back to 1880 and counted among its guests André Malraux, Somerset Maugham and Graham Greene—when he was not snoozing in an opium den. Its terrace, nicknamed the "Continental Shelf," which was a wartime watering hole for officials, journalists, tipsters, covert enemy agents and prostitutes, is now, alas, an air-conditioned pizzeria.

Vietnamese describe Saigon's rhythm as *song voi*, or "fast tempo." At least 50,000 hookers are at work, a sharp increase since 1975, when Communists vowed to eradicate debauchery, supposedly left over from the bad old colonial days. Exquisite in microskirts or loose silk *ao dais*, they operate in bars, cafés and massage parlors, or boldly accost potential clients from motorbikes. A while back the vice squad raided the Bambi Bar, whose proprietor, Nguyen Thi Tot, an overzealous champion of capitalism, was doubling as a madame with the complicity of the Communist Party. Officials and cops kept her provided with customers.

Like the rest of the world, Vietnam is in thrall to American pop culture. Vintage Tracy and Hepburn

Ex-refugee Nguyen Trung Truc, 43, a rich businessman, now works in Saigon and collects classic Citroën cars.



A trio of bank clerks on lunch break in Saigon wear traditional *ao dais*, like many female office workers.

movies appear on television along with Cable News Network. Vendors hawk Snoopy tote bags, Michael Jackson posters and T-shirts emblazoned with "Good Morning Vietnam," the title of a Robin Williams film. Coke and Pepsi battle for the soft-drink market; a Baskin-Robbins branch offers its familiar spectrum of flavors. There is a bar called Apocalypse Now. I spotted the announcement of a forthcoming beauty pageant and a concert by one Elvis Phuong, a local rock star. During the war I often grabbed a snack at Cheap Charlie's, a Chinese bistro; it has been transformed into another fast-food joint titled HAM-BU-GO CA-LI-PHO-NIA.

When I first set foot in Saigon more than 35 years ago, educated Vietnamese spoke French. Today English, regarded as a necessary business tool, is the foreign language of choice. Signs advertise English lessons; and the demand for instructors has lured quite a few young Americans to Vietnam. Bookstores are crammed with *English Made Easy* and *Business Correspondence in English.* Also with pirated American titles—including one of my own—mailed by relatives in the United States and reprinted on copying machines.

One morning I bumped over a rutted dirt road to Dong An, a village concealed among trees miles out of town. Children and chickens swarmed its streets. A sinewy peasant named Duong Van invited me into his home, which was sparsely furnished with chairs, tables, frame beds and a black-and-white television set. On a wall, next to the requisite portraits of his parents and Ho Chi Minh, he had chalked up proverbs like "It never rains but it pours" and "A stitch in time saves nine." He learned them from an English course on television, he explained, adding, "I am teaching my children English. It will be useful to them when they grow up. They can leave here, go to the city, get into business and care for me in my old age."

Among Yankee tourists: veterans, surfers, bikers

In 1995 an estimated 10,000 Americans visited Vietnam. A few were relatives of soldiers missing in action for whom the Vietnamese government is finally trying to account fully. But most come for pleasure or out of curiosity. A team of surfers arrived to ride the waves at Danang, known to G.I.'s during the war as China Beach; one adventurous group traveled around the country by bicycle. Numbers of the tourists were veterans. "It's weird," one said. "I've got a better reception as an American returning to Vietnam than I did as a Vietnam veteran returning to America." They trek through villages and around rice paddies that were once battlegrounds; a few even encounter former foes. A favorite excursion is to the labyrinth of tunnels at Cu Chi, north of Saigon, from which the Vietcong attacked the city. Some fall prey to peddlers selling fake dog tags and Zippo lighters

engraved with the emblems of American Army units.

The American legacy in Vietnam runs deeper than Americans realize. I kept meeting Vietnamese who had worked for the United States during the war. One was the middle-aged woman who approached me on a ferry crossing a Mekong Delta river. To my surprise, she spoke passable English. Did I know Sergeant McNeil, the manager of the officers' club where she had been a waitress? She had lost her identity card, she explained, and could not prove she had worked there. I guessed she had destroyed the card to avoid being sent to a re-education camp by the Communists.

An estimated two million Vietnamese soldiers and civilians were killed—a sacrifice felt by every family North and South. Over beers in a Hanoi bistro I reminisced with Bao Ninh, a shaggy-haired North Vietnamese veteran in his early 40s whose novel *The Sorrow of War* was decried by Communist propagandists for focusing not on the war's glories but on its "dark and utterly tragic" side. He fought for six years. "I would have surely been killed," he said, "if the fighting had gone on. It depresses me to think about our losses. We had to win, but we should not look back on it as heroic or on ourselves as superhuman."

Burying grudges in favor of business

There have been harsh feelings between South and North. But maybe because they have waged so many wars in past centuries, or are too busy rebuilding their country, most Vietnamese don't rehash recent history. If they blame the United States for devastating large parts of this country, they show little resentment. The only visitors I noticed at the American "war crimes" museum in Saigon were foreigners. In Hanoi, trophy American aircraft and tanks stand at the entrance to the city's war museum—but I observed that the main display inside was a diorama of Vietnam's triumph over the Mongols in 1287.

Over tea I talked with an elderly Communist who a decade ago would have denounced the United States as the source of all evil. Now she exclaimed, "I'm astonished by what I see of America on television—automobiles, refrigerators, private homes. Such abundance! The United States ought to be our model."

Compared with frenetic Saigon, Hanoi, with its population of three million, creeps toward the future at a snail's pace. One of Asia's oldest cities, it attained its golden age under the emperor Le Loi, who ousted the Chinese in the 15th century and shares Ho Chi Minh's status as a national savior.

In the 19th century, the French adopted Hanoi as the capital of their colonial administration. They paved the streets and lined them with trees, and erected stucco villas with spacious verandas, tile roofs and curled eaves—

Outdoor barbers, like this one shaving a customer at a site near the city's circus, are a Hanoi specialty.

Hand-painted Coke ads, signs of a Yankee-Vietnamese deal, first went up in 1994 and now flood the country.

a style caricatured as "Norman pagoda." They constructed imposing office buildings surrounded by lush gardens and duplicated the Saigon opera house.

When I was in Hanoi in 1981, not a needle or a bar of soap could be found in its empty shops. People spent hours foraging for a scrap of food or a stick of firewood. Ragged families straggled into town from areas that suffered from actual famine. They begged in front of hotels, and huddled together for warmth on pavements on cold, drizzly nights. The old French villas, victims of humidity, had decayed; the historic temples were crumbling. Today, in contrast, two new and grotesque granite edifices stand out—one a museum containing Ho's memorabilia, the other a mausoleum exhibiting his embalmed body, conceived by Soviet architects to imitate Lenin's tomb in Moscow.

Ho would be appalled. In his will he specified that his ashes be buried on three unmarked hilltops around the country. "Cremation," he wrote, "is not only good from the point of view of hygiene, but it saves farmland." Seeking to bask in his refracted glory, however, his successors violated his wish. The revelation of what they'd done caused a sensation in 1989, just 20 years after his death, when finally divulged by his former secretary. But mausoleum builders sensed the public's veneration for Ho; every day masses of Vietnamese shuffle into the tomb, many carrying infants, many weeping as they gaze at the waxen corpse.

On that early journey I stayed at the Thong Nhat, or "Reunification" hotel, once the ornate Metropole, opened by its French owners in 1911. Paint flaked from its ceilings, and its plumbing leaked. Rats scurried around in the lobby, where outmoded European leftists exchanged fatuous revolutionary jargon with Asian, African and Latin American insurgents then often trained in Vietnam. Meticulously restored by a French conglomerate in partnership with Vietnam's tourist board, the Metropole reopened in March 1992. It could be a glitzy Paris hotel—and, while still primarily patronized by foreigners, it nevertheless symbolizes Hanoi's transformation. So, though the Communists defeated the South, in the North the truculent commercial spirit of the South has overcome party doctrine.

Traffic lights have been installed at a few strategic corners. Mildewed old French villas have been spruced up and let as offices and homes to foreigners at outrageous rents. The "Hanoi Hilton," as the American prisoners of war held there called their block-long jail, has been demolished to make way for a huge office complex financed by money from Singapore. One day my guide steered me to a suburb to see "Hanoi's Beverly Hills."

Stanley Karnow won a Pulitzer Prize for In Our Image: America's Empire in the Philippines. *He is also the author of* Vietnam: A History.

Signs of change in north: thriving potter Le Van Cam; expensive new waterside villa site on West Lake (top).

Rising out of the mud were gaudy houses adorned with fantasy cupolas and stairways climbing to balconies ringed by carved balustrades (above). The helter-skelter construction is a danger to the web of dikes that protect the city against chronic flooding from the nearby Red River, but little has been done to curb the real estate speculators. With official connivance they lease state-owned land, build or renovate other houses, collect two or three years' rent in advance from tenants, then parlay the money into new properties.

Most of Hanoi still exudes charm, however. I indulged myself in a trim by an outdoor barber, and paid a dollar to a wrinkled crone to be weighed on a creaky scale. Wandering into a narrow alley I joined a table of Viet-

King's Island Golf Resort is for rich Asian businessmen; fashion-show models shocked the North Vietnamese.

namese, slurping their midday *pho*—a soup of beef or chicken mixed with cabbage, scallions, bean sprouts and rice noodles and laced with coriander, garlic and the national condiment, *nuoc mam*, made from fermented fish. I explored Hanoi's quarter, the Thirty-Six Old Streets, each named for a separate guild or its specialty—goldsmiths, weavers, dyers; silk, bronze or lacquer. Their wares were reserved for the imperial court until they became famous beyond Vietnam, and foreign merchants streamed in. By the 18th century, wrote a Western missionary at the time, the city was busier than Venice.

Some skilled craftsmen have survived. In the village of Bat Trang, about ten miles from Hanoi, all 3,000 inhabitants make ceramics—as their ancestors have for six centuries. Le Van Cam, a stocky, bearded master potter of 65, lost a leg while fighting the French. Leaning on a cane he took me around his compound, pointing to the mounds of local clay that make his ceramics special. Most of his profit comes from roofing tiles, but he prefers to copy antiques with a glaze that he perfected. He stopped to kowtow at a shrine to his dead sister; then, as we sank into armchairs under a certificate attesting to his Communist Party membership, he poured the inevitable tea—and condemned the Communists.

"They provided us with social welfare," he said, "but they didn't understand the need for incentives. They saddled us with corrupt, incompetent managers. A few years ago, I managed a cooperative that produced rice

Biking to work, Vietnamese pass billboard extolling joys of new Hanoi Club, which none of them can join. Entry fees go as high as $20,000, and facilities are unfinished; most of the club's members are foreign.

bowls. My family lived in one room, and all I had was a bicycle. Since the reforms, I've been running my own company. Now I have a big house, a television set, a videocassette recorder, even a washing machine. If I had a garage I'd buy a car."

For Le Van Cam and others the new freedom is nevertheless circumscribed by the "market economy within a socialist framework"—the transparent Communist euphemism for state capitalism. Government involvement in business is pervasive. The army is engaged in everything from construction to leasing sites for golf courses. The ministry of industry operates factories; the ministry of agriculture sells fertilizer. The foreign ministry charges visiting journalists $50 a day for guides who earn $100 a month. Paid wretched wages, some officials take kickbacks and filch funds—though most, at least in the top echelons, reap their rewards from perks like chauffeur-driven automobiles and junkets abroad.

Officials routinely favor wives and other relatives with contracts for supplies that, by no coincidence, are purchased by party and government bureaus. The son-in-law of one top figure, for example, has the franchise to import the computers used by the party and government. Functionaries moonlight in private companies that deal with the regime. One official, who works for an import-export outfit at night, confided to me, "There's simply no other way I can make ends meet."

Individual entrepreneurs are still rare, though a handful, mostly restaurateurs, hoteliers, real estate speculators and small manufacturers, have accumulated millions. Everyone relies on the overseas Chinese congregated in Cholon, the Saigon Chinatown. The regime expelled masses of them late in the 1970s, when Vietnam and China clashed. But many managed to stay, and, as they have for years, they now quietly play a pivotal role in finance.

Thousands of former refugees have been flocking back, too, especially from the United States. Called Viet Kieus—"overseas Vietnamese"—they include graduates of topflight U.S. business and law schools who act as intermediaries to foreign investors or invest themselves. Others, known as "spacemen," shuttle back and forth across the Pacific, trying to stitch together deals; some inveigle local women into bogus marriages. The Vietnamese view ex-refugees with esteem, envy or contempt, depending on their conduct. The regime tends to regard them with suspicion, as it does all its expatriates.

One of the most successful, Nguyen Trung Truc, is a

diminutive dynamo of 43. In partnership with Peregrine, a Hong Kong investment empire, he and his wife, a Malaysian of Chinese origin, control distributorships that import John Deere farm machinery, Johnson & Johnson baby products, and Mercedes and Honda cars, which sell despite astronomic duties. (Cost of a new Honda Accord: $55,000.) They own a bank and represent an insurance company. They export coffee and have two offshore oil concessions. The company, Truc calculates, is worth about $20 million, and would be more valuable if Vietnam had a stock market on which its shares, traded publicly, could rise in value.

The Trucs keep a low profile but have expensive tastes. His office is located on the grounds of South Vietnam's former presidential palace, and he himself lives in a fancy French villa. His "weakness," as he puts it, is his fleet of 17 antique French Citroëns, but mostly he zigzags through congested Saigon traffic on a motorbike.

One of ten children of a poor peasant, Truc was born in the Mekong Delta. In 1972 he won a scholarship to study economics in an Australian university. After graduation he took jobs in Papua New Guinea, and then Australia. In 1989 he returned to Vietnam with his wife, who is also an economist. They opened a tourist agency but shut it when their clients, mostly Asian businessmen, demanded sex as well as travel. Soon afterward they teamed up with Peregrine, which was expanding with Hong Kong and Chinese government capital.

Truc had a rough start. State enterprises reneged on contracts, officials planted rumors that he worked for the Central Intelligence Agency. He was hounded by cops angling for payoffs until his sister, an influential Communist, fended them off. Corruption still nags at him; to clear a cargo at the port, he says, he must grease the palms of "every Tom, Dick and Harry," from customs inspectors to dockhands. But he has learned a few tricks: he counts on the security police, who for a percentage collect his overdue bills by delaying the debtors' applications for a driving permit or perhaps a change of residence. "The alternative," he observes, "would be to hire a gangster to break their arm."

Last July, at a subdued White House ceremony, President Clinton extended full recognition to Vietnam. Though the Vietnamese government and many American businessmen applauded the move as a spur to better economic links between the former foes, hurdles lie ahead. For example, Vietnam cannot benefit from the Overseas Private Investment Corporation, which insures U.S. investments abroad, unless it fulfills such conditions as permitting free immigration and improving its rather abysmal human rights record. But, Vietnamese foreign minister Nguyen Manh Cam noted to Secretary of State Warren Christopher, the new relationship between the two countries should depend on "noninterference in each other's internal affairs." So Vietnam may well remain, as it has been until now, "the biggest investment tease in Asia."

Attracted by rosy forecasts, foreign businessmen often swiftly sink into a bureaucratic swamp. Obtaining an investment license can require the approval of at least a dozen ministries and committees. Foreigners are barred from leasing property, which lets Vietnamese acquire a major stake in a joint venture merely by contributing an overpriced site. If enforced, a recent law could compel foreigners to pay up to half their income in taxes. The regime restricts the local staff a foreign company may employ, including maids and drivers. The customs requires duties to be paid on all personal belongings; even a pair of dirty sweatsocks is theoretically subject to tariff. Customs officials are notably crooked

Each day throngs of Vietnamese line up to see the body of revered war leader Ho Chi Minh, who died in 1969.

as well; not long ago, frustrated by demands for bribes, an American corporate executive dumped a shipment of computer software into Saigon Harbor.

The prime minister, Vo Van Kiet, a dedicated reformer, regularly deplores all the red tape. His appeals, however, evoke an old Vietnamese adage: "The emperor's authority stops at the edge of the village." Either out of inertia or jealous of their prerogatives, local officials frequently manage to ignore his directives. Even before recognition, when the U.S. Chamber of Commerce in Saigon planned a meeting to celebrate President Clinton's decision to lift the American embargo on trade with Vietnam, the Ho Chi Minh People's Committee canceled the meeting; the chamber did not have a permit for a public gathering. Commented an American businessman, "The head of the dragon knows where it's going but I'm not sure the tail does."

Biggest investors? Taiwan and South Korea

Consequently, serious foreign investment, though much reported in the U.S. press, has in fact been undramatic. Over the next decade, experts estimate, Vietnam will need at least $16 billion in outside capital to continue its growth. So far, only $2 billion has been disbursed. The biggest investors, paradoxically, are Taiwan and South Korea, the fiercest anti-Communist nations in Asia. Despite expectations that American firms would stampede in after the embargo was revoked, they have signed up for only $700 million—a large chunk of it in the offshore oil sector. Nor have American investments swelled as expected since the United States and Vietnam established full diplomatic relations. Michael J. Scown, an American lawyer in Saigon, emphasizes that the Vietnamese and their promoters delude themselves in presuming that foreigners can't wait to buy in under any circumstances. "Businessmen are a hardheaded bunch," he says. "They're not going to put up with headaches when they have other options elsewhere."

Vietnam's long-range prospects hinge on developing the countryside, where families seldom earn more than a few hundred dollars a year and often live in want. Nothing that I have seen was more preposterous and misleading than a spread of color photographs in the *New York Times Magazine* showing beautiful Vietnamese women posing in ricefields, wearing Chanel, Mizrahi and other designer versions of native dresses costing as much as $3,000 each. Motoring through the Vietnam provinces, North and South alike, is like entering a time warp. Shimmering paddy fields mirror peasants, both men and women, their slender bodies bent over to transplant tender rice stalks. Some of them wade waist-high through streams and canals, casting triangular nets for fish and shrimp. Laughing boys splash in ponds while, silhouetted against the horizon, a solitary figure is yoked to his plow behind a plodding water buffalo.

This idyll is deceptive. Apart from television sets, often run on batteries, the villages resemble those I recall from a generation ago. Ramshackle houses mostly have no running water or indoor toilets. Extended families, from grandparents to infants, sleep in the same room. Dysentery and malaria are endemic; half the children in rural areas suffer from malnutrition. Only a small fraction of Vietnam is arable; with a population of 73 million increasing by one million a year, more and more young men are underemployed. Bridges are scarce. I had to cross two rivers by ferry on a 100-mile drive north of Hanoi—a journey that took five hours. Country roads become quagmires in rainy weather; peasants find it hard to get their rice to market.

Recently approved by the Communist regime to study Vietnam's progress, a group of Harvard economists bluntly warned that despite the nation's extraordinary rebound, the "gains achieved so far are extremely fragile." The rapid growth could fade unless it can be sustained, they cautioned—"The reforms, begun with a bang, are turning to whimpers." Among their catalog of recommendations: the vague laws should be clarified, the onerous regulations for foreign investors relaxed, the sluggish bureaucracy streamlined and privileged state enterprise monopolies dismantled so that free competition may flourish. They concluded, "The question is not whether Vietnam can succeed, for it can. The doubt is whether it will."

To fulfill even some of the Harvard proposals would entail a drastic overhaul of the Communist system—hardly a likelihood for the near future. Nevertheless, a number of foreign experts suggest, too many senior Vietnamese officials are committed to change to hold back economic reforms for long.

Among the optimists is Eugene Matthews, a 36-year-old Harvard Law School graduate who settled in Hanoi in 1990 on the gamble that Vietnam would eventually be opened to American business. He learned Vietnamese and is now a consultant to such corporations as Revlon, Lehman Brothers and American Express. Figuring that profits can be made by weaning the Vietnamese away from condensed milk—one of their staples—he plans to import a herd of cows and start a dairy. Too young to have fought in the war or protest against it, he looks forward rather than backward. Vietnam, Matthews maintains, has immense potential for foreign investors—if only they take the time to understand its strengths and weaknesses. "It's a country, not a war," he asserts. "Don't sell these people short."

On a lakeshore near Danang, young peasant girls dig for clams, a main source of protein for local families.

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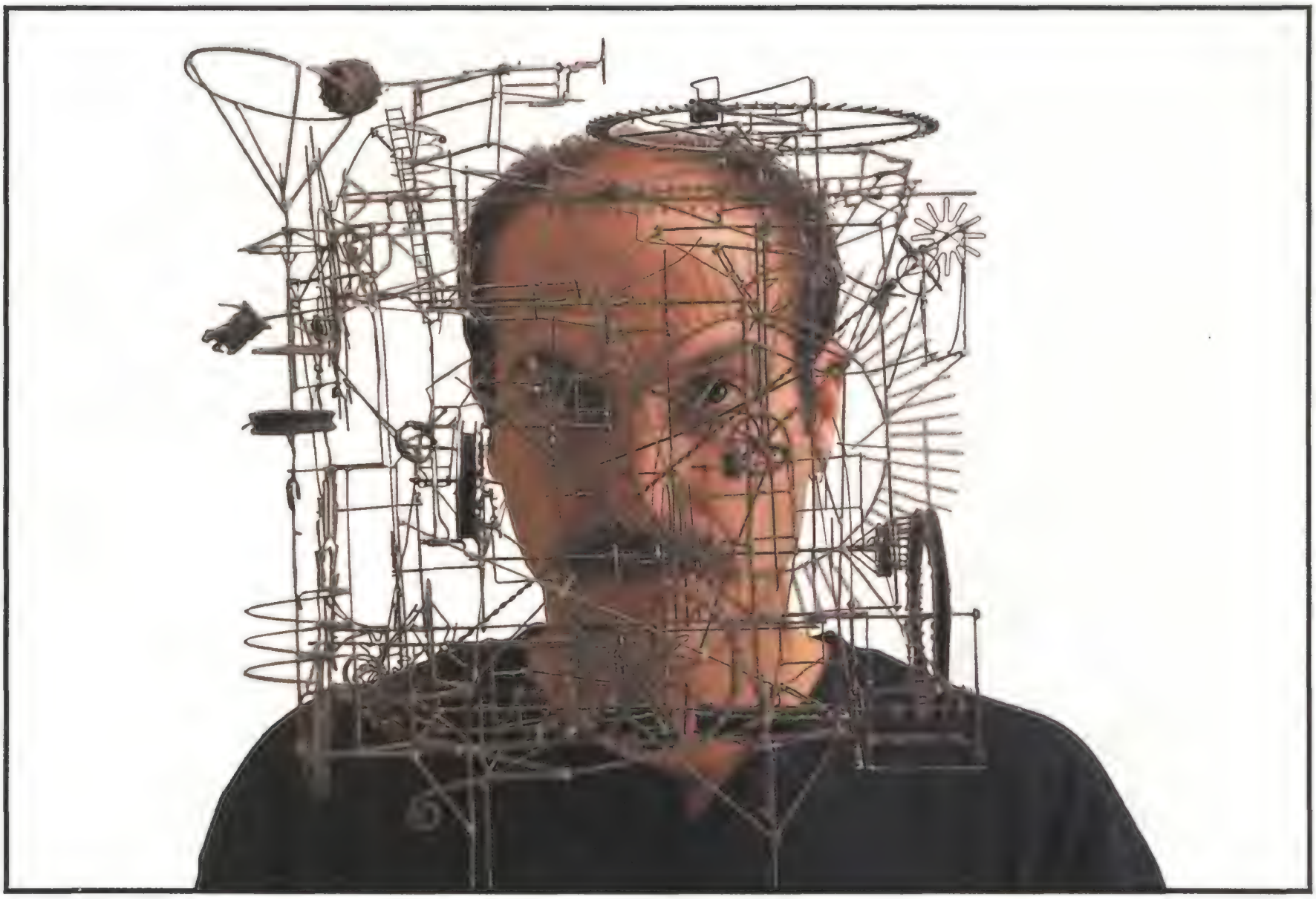
The Ultimate

In this time-lapse photograph of Ganson's *Machine with Chair*, 1995 version, a four-wheeled vehicle moves along a track, picks up a chair in its path, lifts it high while passing underneath, then sets it back down.

By David Sims

You can almost hear the gears turn inside his head

MIT sculptor Arthur Ganson is on a roll, creating machines that whir and clack as they seem to take on a life of their own



Arthur Ganson, kneeling trackside to his kinetic sculpture *Machine with Chair*, wipes his face slowly with his palm, then cups both hands together, prayer-like, against his chin. Lean and angular, dressed in a grimy black jumpsuit, black woolen cap and combat boots, he looks like a mechanic supplicating the god of gears and gizmos. The sculpture—a redesigned version of the 1992 original—is due at a national inventors hall of fame in Ohio three days hence, and time is running out. Fixing his gaze on the 800-pound, aluminum-and-steel sculpture in front of him, Ganson grabs a wrench from a heap of tools scattered on the floor and begins to torque and tweak the beast to life.

If *Machine with Chair* were up and running, it would roll slowly down its 30-foot track, pluck a bentwood chair out of its way, lift and flip the chair with a baroque flourish and set it down again in the exact same spot on the track—only now, safely behind the advancing ma-

Photographs by Henry Groskinsky

chine. At the moment, however, *Chair* is suspended upside down, six feet above Ganson's head, by an articulated aluminum arm. It looks like a gauzy ballerina held in midflight by her robust dance partner, *Machine.*

Indeed, it is the "dance" performed by *Machine with Chair* that so captivates viewers, as cold, rigid, mechanical motion metamorphoses into a graceful, ethereal, silent ballet.

Conjuring such transformational magic from sprockets and spot-welded wire gears, levers and four-bar linkages is Arthur Ganson's gift. For a decade and a half, this self-taught engineer and current artist-in-residence at the Massachusetts Institute of Technology has been dreaming up and building machines that transcend their very "machineness." He does so by exploring what he calls the "esthetics of motion," and by capturing the "mechanics of gesture." The result is machines with attitude. Anyone can build a machine that can wave, says one astute observer of Ganson's creations; "Arthur knows how to make a machine that waves goodbye."

The pleasure of bathing itself—in motor oil

The sculptor has found a visual language that seems to have universal appeal. At a Ganson exhibit gape-mouthed 6-year-olds will scrawl a scribbly half-page "WOW" across the visitor comment book, while gimlet-eyed mechanical engineers come back again and again and take notes.

For this is what they see. *Machine with Oil* slowly whirls its one arm, dips a silvery, rectangular bucket into a pool of glistening motor oil, lifts the bucket and bathes itself in a gesture of semierotic, self-indulgent pleasure. With glacial slowness, *Machine with Fabric* lowers a swatch of blue satin, capturing the thick, liquid movement hidden in a piece of fabric. *Brownian Rice* is a simple box-of-a-machine that, by means of a hand crank, imbues grains of rice with the invisible molecular energy of waves. *The Dream* evolves from labored and leaden motion at its base to a point ten feet up, where wispy wire things sweep delicately through the air; it could have sprouted from a metallic seed.

Ganson's machines hurl knives, spurt grease, unfold Chinese fans and make a chicken's wishbone walk. They chirp like birds, dust frantically, breathe deeply and talk back via handwritten notes. They pose existential questions, plumb spiritual depths, make elegant jokes and stupid puns. These machines do "nothing," yet work extraordinarily well, particularly at making people laugh.

A sampling of viewer comments from Ganson's one-man, 40-work exhibit at the DeCordova Museum in Lincoln, Massachusetts: "I wondered why my cheeks were aching as we left this gallery. Too much smiling and pleasure." "Funny and scary, what more could you want?" "First I didn't want to come. Now I'll bring my birthday party here!" "I usually *hate* Sundays. *You* made me laugh!" The artist himself was struck with a darker thought once the works were up and running. Smiling broadly, Ganson says, "I remember walking around after the show was set up and thinking, My God, I'm so insane. Where do all these come from?"

No one has ever suggested that Arthur Ganson has a few loose screws. On the contrary, the "genius" label is often used to describe the 40-year-old Woburn, Massachusetts, kinematic sculptor. People who know him best know that his elegant and whimsical mechanisms, his "funny little useless machines," as the artist has referred to them, come from Ganson's ability to "play" in spite of himself. For he is a driven, disciplined, angst-filled man who explains that he is a former unhappy child and withdrawn adolescent who didn't know how to communicate his feelings and who turned his solitary, escapist tendencies of "making stuff" into a career. "I mean, anyone can do what I'm doing," he says with characteristic modesty. "The skills involved are very minimal. It's just the ideas, it's just having something to say."

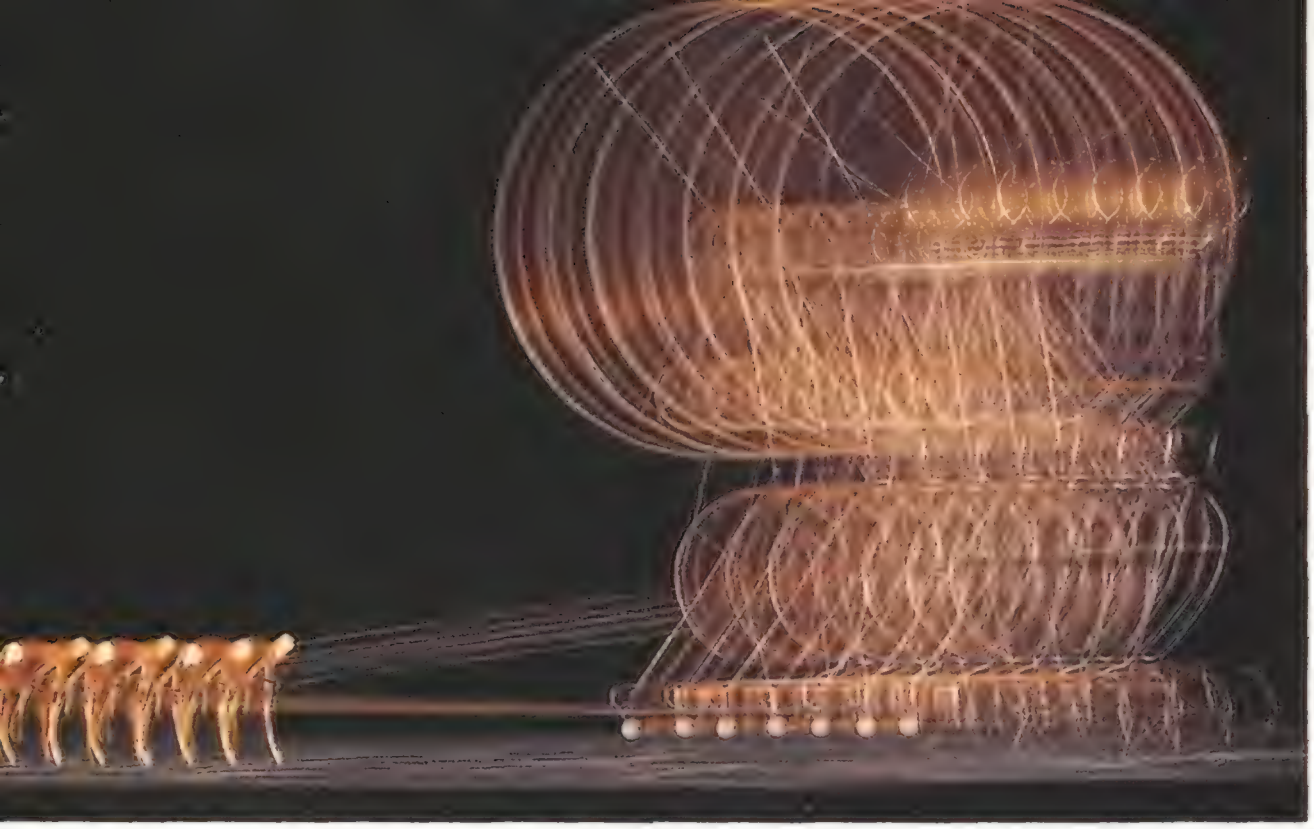
Ganson has found his voice, and it rarely shuts up.

"That's a pretty fluid place up there and it's endlessly on," says a grinning Rocky Tomascoff, referring to the gears that whir inside her husband's balding head. "All that turmoil and angst just keeps spitting things out, and in spite of all the struggle, so many pieces have so much humor." Tomascoff knows, intimately; disregarding the sign above the door to their bedroom that sternly pronounces, "NO Machines," for the couple's first wedding anniversary, Ganson had chocolate and sake delivered to his wife's bedside on a slowly descending mechanical cloud.

A man possessed, talking rapid-fire, blinky-eyed

There are Ganson machines throughout the house, including the room of 5-year-old son, Cory, who habitually makes elaborate line drawings of machines. "It's in the genes," says the boy's mother with a roll of the eyes. Tomascoff is an animated woman. Clearly, little Cory has double-dipped in that department; his father is positively possessed. With an energy level that would shame a preschooler, Ganson tends not to walk but, rather, charges at a 10-degree angle getting from here to there. Talking about his sculpture-making, which he describes as being part of an "obsession with wanting to understand my relationship with the world," he gives a rapid-fire, blinky-eyed delivery.

It is with this fervor that Ganson engages in what he calls the "haphazard, exploratory, playful and intuitive" process that gives birth to his machine-sculptures. Fellow Boston-area kinetic artist William Wainwright describes his friend as the possessor of "a unique mind, at loose" and believes further that part of Ganson's genius



In *Machine with Wishbone* (left), a tiny wishbone seems to be towing along the contraption behind it.

The intricate moving parts of *Prayer Wheels* (above) cause wings mounted at the top of the rods to slowly beat.

Machine with Fabric (right) lowers and lifts satin so slowly it seems like liquid; then a fan plays on it.

As the *Machine with Grease* (above) pumps, grease spurts out the top and sensuously flows down the pump.

As the *Machine with Breath* (above) moves up and down, bellows upon which it sits inhales and exhales.

is his ability to, simply, "not shut things out." Other artist friends describe Ganson's artistic modus operandi variously as "magical," "monster tinkering," "childlike" and "a sophisticated engagement with the world." Or, perhaps, disengagement.

Ganson credits a "lost in space" state of mind he is prone to for his creative prowess. Lost in space, Ganson envisioned *Machine with Wishbone*, a whirring, wire-wheeled machine yoked to a chicken's wishbone, which swaggers like a cocky cowboy in chaps, machine in tow.

Lost in space, Ganson forgets the time but can construct in his head a concoction of worm gears, bearings and linkages that elegantly teeters on the edge of applied physics. Lost, he forgets to apply the brakes of his truck. Last year, ruminating over some aspect of a machine, Ganson plowed into the back of a city bus. "It never occurred to me that the bus was not moving," he says with a bemused grin.

But lately, of necessity, Ganson has been very much down to earth, working more and playing less, wrestling with the outcomes of his own converging success. As part of his MIT residency, he had a one-man show of his machine-sculptures at the MIT Museum's Compton Gallery. So popular was the exhibit that the artist-engineer has been asked to provide works for permanent display at the Cambridge museum.

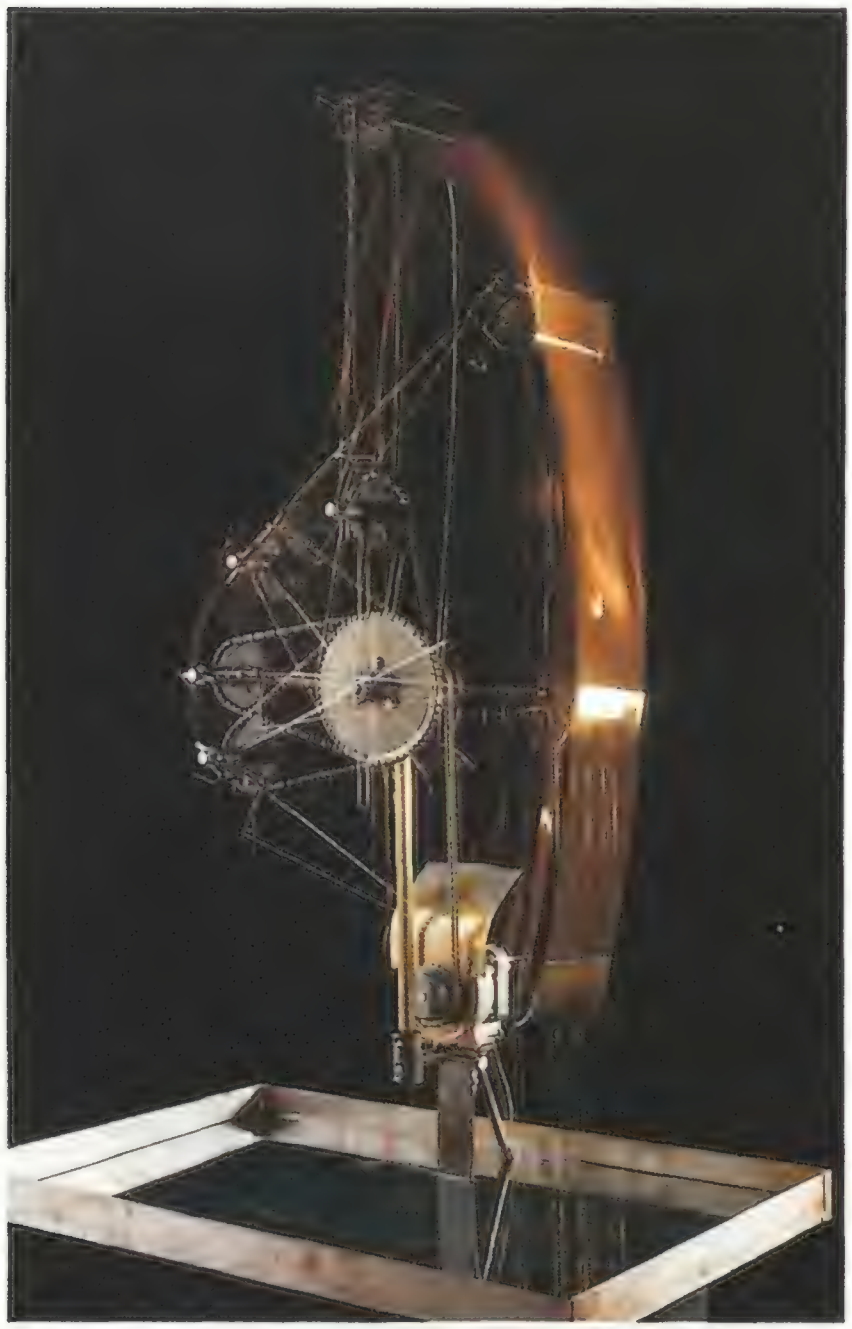
Referring to the impact Ganson's show had on the students who daily mobbed the gallery, Joan Loria, director of exhibitions at the museum, says with a wide-eyed shake of her head, "It just blew their minds." Which is good news to Woodie Flowers, MIT Pappalardo Professor of Mechanical Engineering and a member of the National Academy of Engineering. Flowers, years ago, started the now famous and widespread contest in which students design Ping-Pong-ball-plucking robots. He believes the creations of his colleague-in-residence should be, in effect, required reading. "Truly effective engineers and technically trained people need to have other dimensions augmented," Flowers says. Of the Ganson Zone, Flowers adds, "My feeling is that Arthur, like some students here, goes off in the night and has affairs with Mother Nature."

Upcoming, too, for Ganson, will be his first venture into the New York art scene—with a SoHo gallery show. It was brought about, in large part, by a Manhattan businessman and art collector who was so taken by the originality and grace of Ganson's sculptures that he purchased a small truckload's worth of the MIT pieces. William Louis-Dreyfus has, in a certain sense, taken on the role of patron.

Says Louis-Dreyfus, "I'm gloriously moved by his work, I can't get over it. It marries fragility and grace with their opposites, and that is very surprising."

And then there's the commercial offspring of Ganson's fertile imagination, Toobers and Zots, which arose from a case of mistaken identity. At a street fair, Ganson thought he saw a child holding a colorful foam tube twisted like a balloon into an animal shape. He wished he'd thought of the idea. He had, for a closer look revealed it *was* a balloon. His knees shook with excitement. Toobers (long foam tubes) and Zots (various small shapes that fit together and onto the tubes) are being manufactured by Ganson and two partners at HandsOnToys Inc., down the road from the artist's studio. Kids make creatures and headgear with Toobers and Zots; adults decorate their car roof racks with them. Ganson and friends expect the toy to reach the $8 million revenue mark this year.

Indeed, it is the current crush of designing and manufacturing production tools to meet the anticipated



Machine with Oil dips its single arm into oil at the bottom, then bathes itself as oil drizzles from above.

David Sims, a freelance writer from Milton, New Hampshire, is not mechanically inclined but has been known to become machinelike as a deadline looms.

Heavy Isn't Healthy.

Excess weight can be associated with certain health conditions

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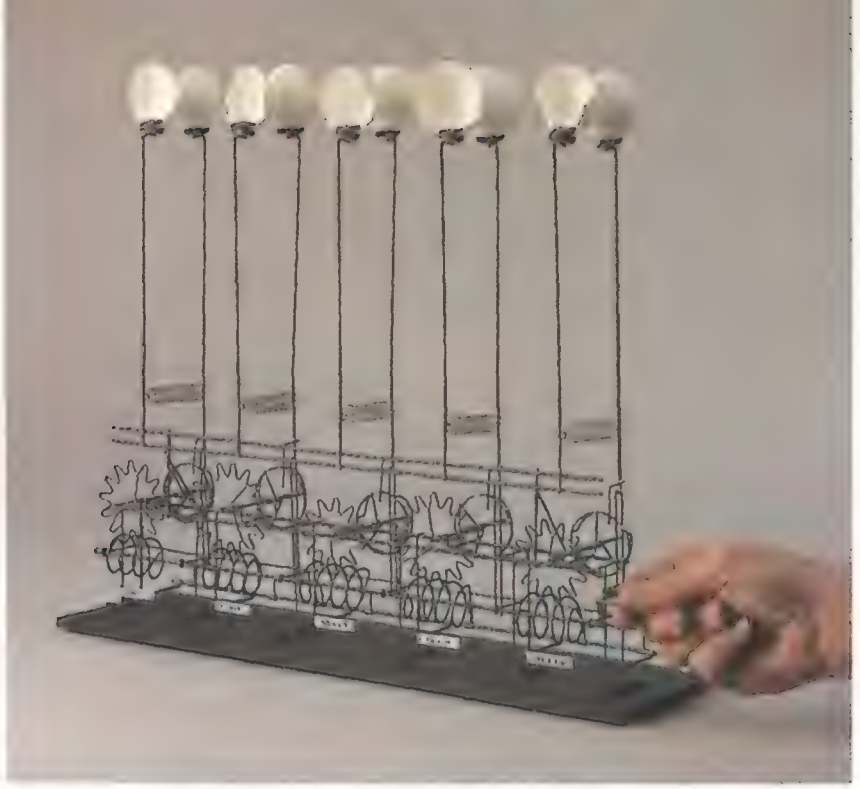

Realizing that eggshells resound when hit together, Ganson created a machine that plays complex rhythms.

Christmas demand for Toobers and Zots that has put Ganson behind the eight ball and, on this day, brought him to his knees in front of *Machine with Chair*—nose to the grindstone, head out of the clouds, an engineer-machinist longing to converse with his muses, who are temporarily on forced sabbatical.

It's 6 P.M. and Ganson, looking wan and grim, is now sprawled flat on his belly staring at the ganglia of colored electrical wires that run into the logic board— the brain—of *Machine with Chair*. The liquid, rhythmic popping sound of a belt-driven lathe fills the air of the cavernous studio space. A red Toober, coiled around a descending utility pipe on the wall, is poised to strike. Two couches in the corner, pillows squashed flat, bespeak long nights and short sleep. For its permanent installation at Inventure Place, the National Inventors Hall of Fame in Akron, Ohio, Ganson has reengineered *Machine with Chair* to operate flawlessly and in perpetuity—like a good machine should. The process has been very much like designing and building toy-manufacturing tools, devoid of the creative magic that spawns his machine-sculptures.

From across the studio comes the voice of Chris Fitch, a longtime Ganson cohort and a kinetic sculptor in his own right. Fitch is one of several talented people here who are working on various Ganson-inspired projects.

"Nobody seems to be very amused over there. Whatever happened to the humor on that side of the room?" chortles a beaming Fitch as he shoves a white plastic tube onto the freshly machined pneumatic press he is constructing for the HandsOnToys factory.

But Fitch's chiding fails to get a rise out of Ganson, who screws a wire to his machine's brain, looks up, wags a finger at the control box and its impressive array of blinking red and green lights and says, "There's lots of stuff going on over there but it's immaterial, it has nothing to do with the piece." More important to Ganson right now is the fact that he has painted *Machine with Chair* a matte black, leaving only the glinting, toothy aluminum edge of the four-foot-diameter main sprocket, which slowly propels the machine back and forth along its track and looks like an oncoming sawmill blade.

Says Ganson, "I want people to look at the overall gesture of the sculpture, not the surface. The piece is painted because it brings all the parts together, and it becomes machine with chair, not complex parts with chair, and that's important."

Surface usually doesn't matter much to Ganson. He makes no attempt to prettify the object or otherwise obscure the piece's underlying idea. He never used to clean the flux off soldered joints, and his finished sculptures usually have a raw, unrefined quality to them. To the inattentive eye, *Machine with Oil*, unplugged, devoid of gesture, could sit anonymously on the back bench of Joe's Garage.

The rawness of his work is a likely reason for its wide appeal. Ganson's machine-sculptures are works of "retrotechnology," with a 19th-century quality to them. No lasers, no subminiaturized computer wizardry. What you see is what you get. And, generally, people get what they see because there are so many different points of entry—an end result of the playful Ganson mind. For example, kids love *Machine with Wishbone* because it's funny, odd and ingenious. Many adults, on the other hand, see pathos and tragedy as the enslaved little bone drags the clanking contraption behind it. Rube Goldberg meets Jean-Paul Sartre.

In metal wings, the grace of a migratory flock

Ganson has been known to play nonstop for days getting a machine to "speak" in the way he first envisioned it. Further, a machine may work brilliantly from a mechanical point of view but fail, utterly, at communicating. Ganson is an inveterate revisionist. For *Prayer Wheels*, he stayed up 96 straight hours completing the sculpture in an all-out creative spurt. About the size of an orange crate on edge, *Prayer Wheels* is a machine that transfers the furious motion of 40 handmade sprockets and rotating coils upward through a series of thin steel rods and Teflon tubes, decelerating the speed to the point where, at the very top, tiny, metal bird's wings slowly, randomly, lift and fall with the gracefulness and mystery of a migratory flock. The delicate squeaking of machinery only adds to the effect.

"It was a piece I saw so clearly and I had such a feeling about it that I had to, just, make it," says Ganson, a deeply spiritual man who is fascinated with Eastern philosophy. "I wanted the center of the piece very calm, with this motion of flying up on top and this hustle and

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bustle activity, the machinations of the world underneath. So it's very much heaven and earth and quietude in between." The piece has moved viewers to tears.

Nonetheless, if he had it to do over again (*Prayer Wheels* now resides in Pittsburgh), Ganson thinks he would replace the wings with ripped scraps of paper, thereby providing viewers more elbow room for personal interpretation. "I have a hard time with art that is so obscure it can mean anything and often ends up meaning nothing. Yet," he adds, "you've got to have a certain amount of ambiguity to allow people to interpret a piece in their own way, to dream with it."

Tweaking away the cramps and spasms

In many ways, Ganson believes, *Machine with Chair* achieves this edge in the most complete way. "It's open-ended. It doesn't pretend to mean anything," he says. It will be meaningless, however, unless he and cohort Joel Murphy can tweak away the cramps and spasms. Finally, at 8:30 P.M., *Machine with Chair*, the sequel, successfully completes its debut performance—reaching its partner, grabbing hold, lifting and twirling fluidly, and setting the chair down again.

Ganson gets a congratulatory squeeze on the shoulder from Murphy, and his black mustache curls upward as he smiles. Briefly. "I'm too anxious to be happy," Ganson blurts out, lunging awkwardly for a screwdriver. But he's happy enough and hungry enough to break for dinner and celebrate. Nervously leaving *Machine with Chair* to test-run on its own, he heads out the door to an Italian restaurant.

It's Friday and lots of people are celebrating. Waiting to be seated, nursing a beer, Ganson suddenly notices his grease-stained hands, the deep grime beneath his nails. He puts down his glass, stares at the long, supple fingers and says with a grin, "Oh, look at that." He picks up his glass again and takes a small sip. Dinner is served and eaten. The hands never do get washed; the chore simply slips his mind. That is, until he returns to his studio to find one of *Chair*'s legs crushed beneath *Machine*'s wheels. He scrubs before laying a hand on his patient.

As a boy, when the other kids were happily mooshing and cutting their multicolored Play-Doh into snakes and pretend pizzas, little Arthur Ganson would make Play-Doh people, inlay them with arteries (red Doh) and veins (blue Doh), and then have them become accident victims. Dr. Ganson, emergency room surgeon, would then repair the mangled circulatory systems.

To that end, the Connecticut-born Ganson eventually found his way to the University of New Hampshire, where he enrolled in the pre-med program. But, unsuited to facts and figures, he turned to the art department, eventually entering the Bachelor of Fine Arts program. There, he began making machines and small soldered wire machine-sculptures; and there he learned of the work of Swiss kinetic sculptor Jean Tinguely.

Ganson felt immediate kinship with Tinguely's work—a kinship that is apparent in Ganson's early sculpture. Clear, too, is the signature of the other artist who most profoundly influenced Ganson, Bauhaus painter Paul Klee; many of Ganson's sculptures etch delicate, Klee-like, black linear shapes in space. Ganson's works recall Constructivism, the movement that pioneered kinetic sculpture, as well as Dada and Surrealism, which injected absurdity (including punning humor), chaos and chance into art.

Which is all well and fine with Ganson. But get artsy on him, and he'll run away in terror. "I'm deathly afraid to get into conversations with 'art types' because I'd come across as really stupid and uninformed. And I don't care," he says casually. With a gleam in his eye he adds, "There's definitely a mainstream art world, and I'm definitely not in it." Not to say Ganson is thumbing his nose; he's just in his own world.

Contrasting Ganson's work with that of Jean Tinguely, curator Nick Capasso of the DeCordova Museum says, "Tinguely's work was more grandiose, theatrical, bombastic, more of a critique of industrialization." Smiling at the self-evident nature of his words, Capasso adds, "Arthur's work is a little more introspective than that."

For anybody in any culture—new ways of seeing

Indeed, Ganson's work is more a fascination with everything, rather than a reaction against anything. "I feel very strongly that the pieces need to stand on their own. I'm not interested in intellectual sculpture that needs to be explained to be understood," says Ganson. "I get so bored with political art. There is no point of view in my pieces—I'm not trying to make a point. In *Machine with Fabric*, for instance, I'm making a statement about the nature of fabric, so that anybody in any culture might look at it and see it as looking like liquid, and this suggests the possibility of seeing all the other things that we haven't seen. And if it makes that connection, then it seems like a worthwhile thing to me." Judging by the comments of those who see Ganson's work, the connection is being made. "Arthur, I think you're healing a lot more of us this way than by your earlier choice of pre-med," wrote a woman in the comment book at the DeCordova exhibit.

And, significantly, other artists praise Ganson's work for its ingenuity, sincerity and clarity. Ross Miller, a Cambridge artist who creates public art projects, has known and worked with Ganson for years. Miller, whose thoughtful, articulate speech is delivered at a stream-of-consciousness pace, equates what Ganson's machines do with the act of an adult who is lovingly and carefully showing a child some small detail of the world—the flut-

tering, slate-gray shadow of a leaf on a sunstruck red brick wall, for example, or the dance of raindrops on the surface of a pond when they're viewed at a swimmer's eye level. Says Miller, "It's like somebody is taking that thing from the world and presenting it to you seriously and saying, 'I care about this, I care enough about this to obviously spend a whole heck of a lot of time making this machine.'"

By 2:30 on this cool March night, Arthur Ganson has spent about as much time on this machine as he cares to for one day. Sitting at a small workbench in a darkly lit corner of his studio, he files down the pin that engages *Machine* to *Chair*. It failed during dinner; it must not fail out in Ohio.

Looking up from his work, he notes the time. He also notes the fact that he's come this far because, for 15 years, he has spent his time capturing the esthetic qualities of things that move through it. He has not had a need for balanced time. Until now.

Softly, he says, "This used to be my food; I thrived on it. But this is where I've ceased to be a studio rat. When I crash here and get up and get to it, I quickly realize this is not who I am anymore, and I need to be home with Rocky and Cory."

But in less than 24 hours, Ganson rigs up the studio's doorbell to ring should the silently dancing *Machine with Chair* falter during the night while he stands guard, horizontally, on the couch.

Ganson crowns himself with some pieces of his own toy creation, Toobers and Zots—flexible foam tubes with wire running through them, and wildly shaped accessory pieces. They've been spotted on cartop roof racks in New England.

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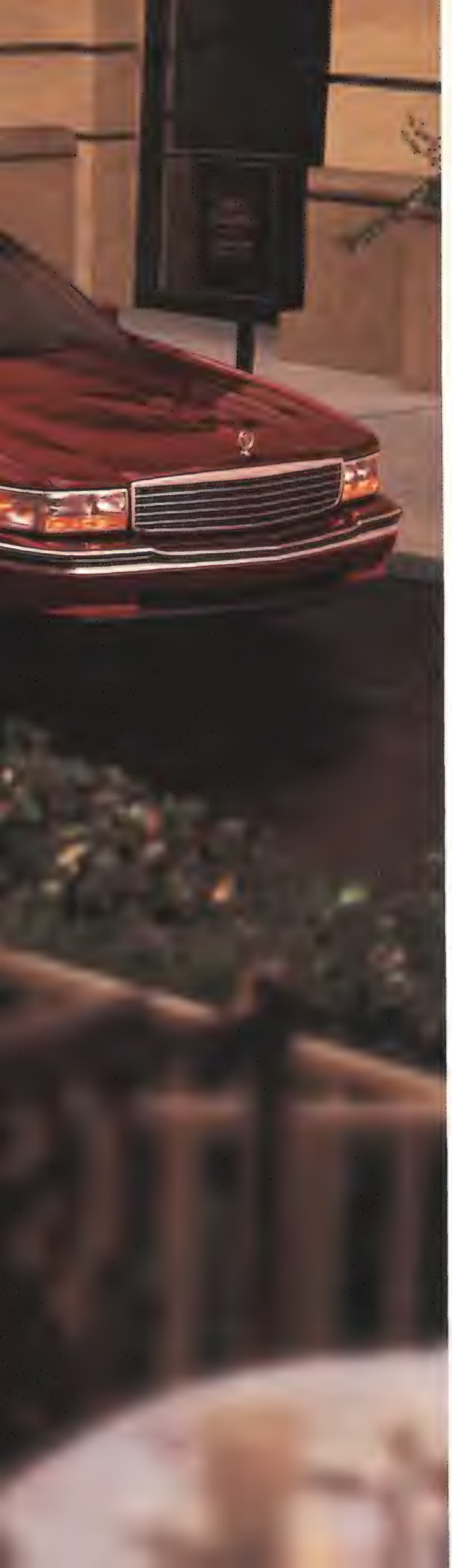

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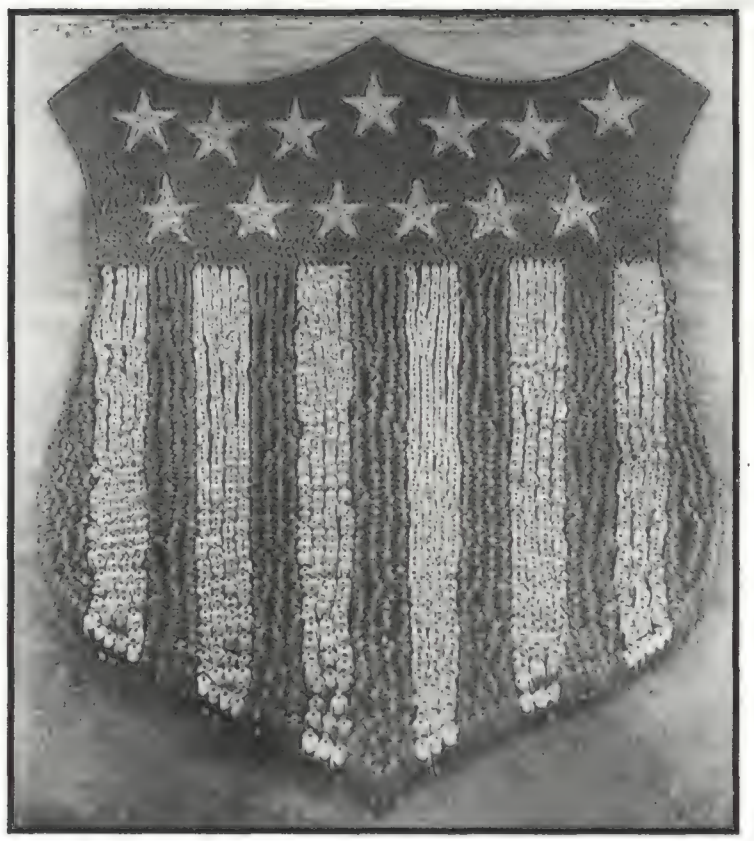
How many sailors does it take to make an American flag?

In the patriotic fervor of World War I, Arthur Mole commanded thousands of troops to produce 'living symbols' from his unique perspective



The Human U.S. Shield: 30,000 officers and men; Camp Custer, Michigan

Could any politician today inspire a tribute like this? In late 1918, amid the euphoria that followed the Allied victory in World War I, 21,000 doughboys-in-training at Camp Sherman, Ohio (suddenly spared from combat in Europe), marched into position to pose for a giant group photograph. The living, breathing, sometimes fidgeting, here and there fainting, but altogether jubilant portrait of their Commander in Chief, Woodrow Wilson (opposite), stretched more than 700 feet from top to bottom. Presented with a print before embarking for the Paris Peace Conference, President Wilson liked it well enough to sign it with a flourish.

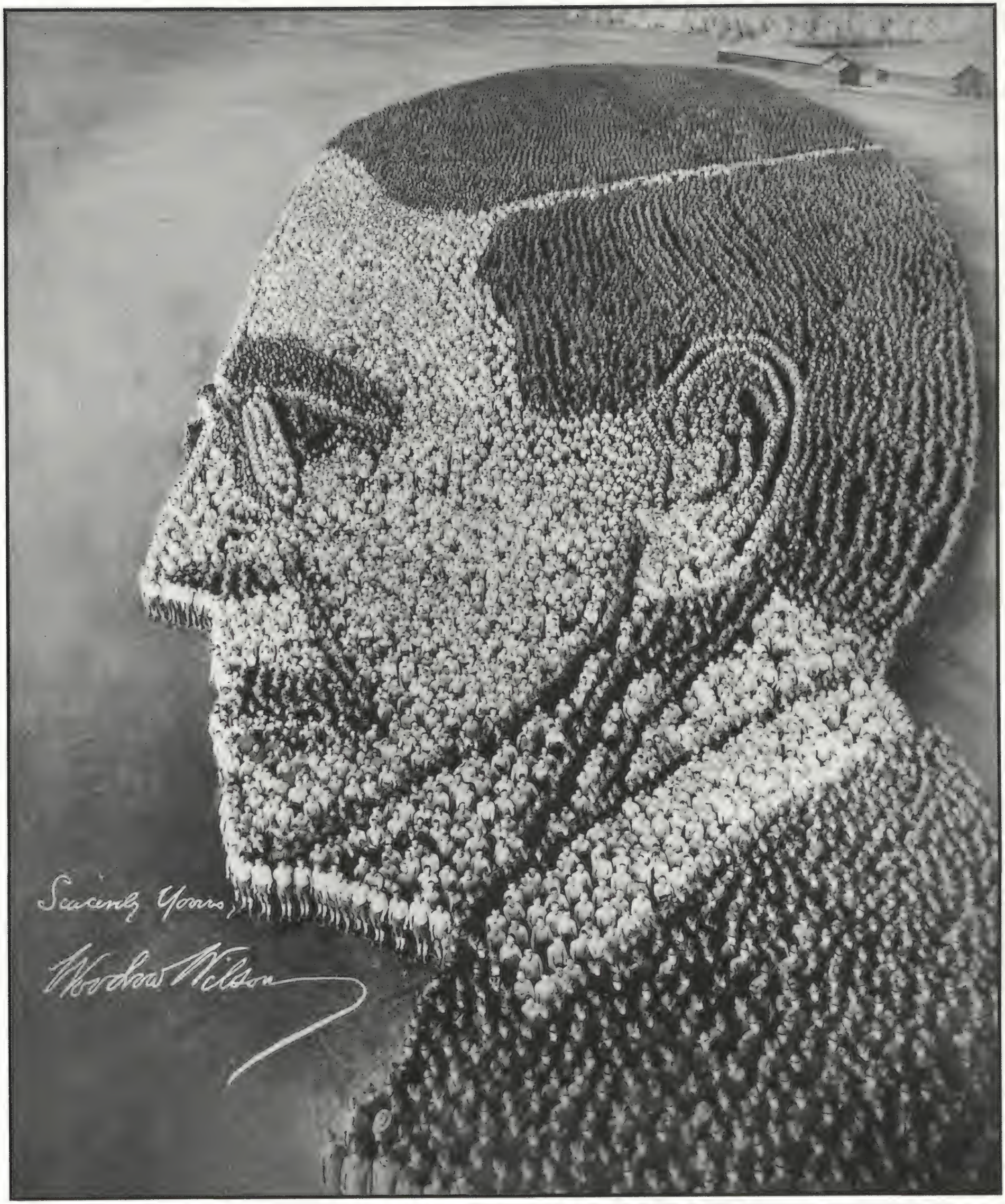
The man who talked the base commander into permitting this bizarre military exercise was a 29-year-old commercial photographer named Arthur S. Mole. Long before Christo, Mole was applying his talents in persuasion and crowd control to fashion huge, festive works of participatory art. During and shortly after World War I, Mole and his partner, John D. Thomas, shuttled around the country from one military camp to another, creating dozens of "living photographs."

Among Mole's short-lived works of human Pointillism was a 25,000-troop Liberty Bell; a Statue of Liberty and an Uncle Sam were composed of 18,000 and 19,000 troops, respectively. His largest work was a 1918 formation of 30,000 recruits at Camp Custer, Michigan, all of them posing just-so as a blemish-free United States shield. Mole's love of patriotic symbols was clearly heartfelt, but his choice of troops as his artistic medium was no doubt influenced by the impossibility of forcing thousands of civilians to stand still for hours at a stretch.

By today's standards, Mole's oeuvre bespeaks a wacky patriotism, a love of country blended with a love of novelty. The American public was smitten with patriotic symbols during and immediately after the war; needlepoint eagles were all the rage in home decor. At the same time, people were fascinated by the new medium of aerial photography, even pseudo aerial photography like Mole's.

Unlike half-time formations at football games, Mole's creations made sense only from one viewpoint: the camera's. His platform was typically a rickety 70- or 80-foot tower that he and his assistants quickly nailed together from one-by-fours and steadied with guy wires. Since the top of an image could be a quarter-mile from the camera, and since a human at that distance is barely a speck, Mole had to crowd most of his posers into these uppermost sections. For his most complicated image, a Statue of Liberty, two-thirds of Mole's 18,000 subjects were squeezed into Lady Liberty's torch; up close, her hemline needed just 17. The resulting illusion is part of what delights a viewer: the designs are as flat and undistorted as a picture hanging on a wall, yet immediately above them a landscape of tents or hills recedes Escherlike into the distance.

For each picture, Mole and Thomas would spend a week or more doing the groundwork, literally. Mole would place a tracing of his desired image on a groundglass plate mounted on his 11-by-14-inch view camera. Then, using a megaphone, body language and, for the



Woodrow Wilson: 21,000 officers and men; Camp Sherman, Ohio

distant sections, a long pole with a white flag tied to the end, Mole would position his helpers as they nailed the pattern to the ground using miles of lace edging. He worked out in advance precisely how many troops would be needed and how they should dress—jackets or shirtsleeves, campaign hats or bare heads.

Mole's earliest formations had devotional themes. During church gatherings before the war in his hometown of Zion, Illinois, he'd pose church members in religious tableaus (the Cross and the Crown, the daily hour of prayer). Mole's interest in art seen from on high may have been influenced by Zion's own street plan, which consisted of biblically named streets laid out as spokes on a wheel with the church as their hub.

For soldier and churchgoer alike, being a tile in one of Mole's giant mosaics was a way to become part of the image's message. Of his first patriotic formation, a 1917 portrait of Old Glory using 10,000 sailors at the U.S. Naval Training Station at Great Lakes, near Zion, the base newspaper reported: "It lived only for a few minutes . . . but its thousands of minute parts will live on for a generation; they will go to different ports of the world on ships of the Navy, each to deliver an earnest blow for Democracy."

At war's end, Mole planned to sail to Europe to assemble his grandest living photograph ever—the entire U.S. Army in Europe posing as a clock with its hand on the eleventh hour, when the Armistice was signed—but demobilization intervened. By the 1920s, demand for his patriotic images had dropped, and he resumed his photography business in Zion.

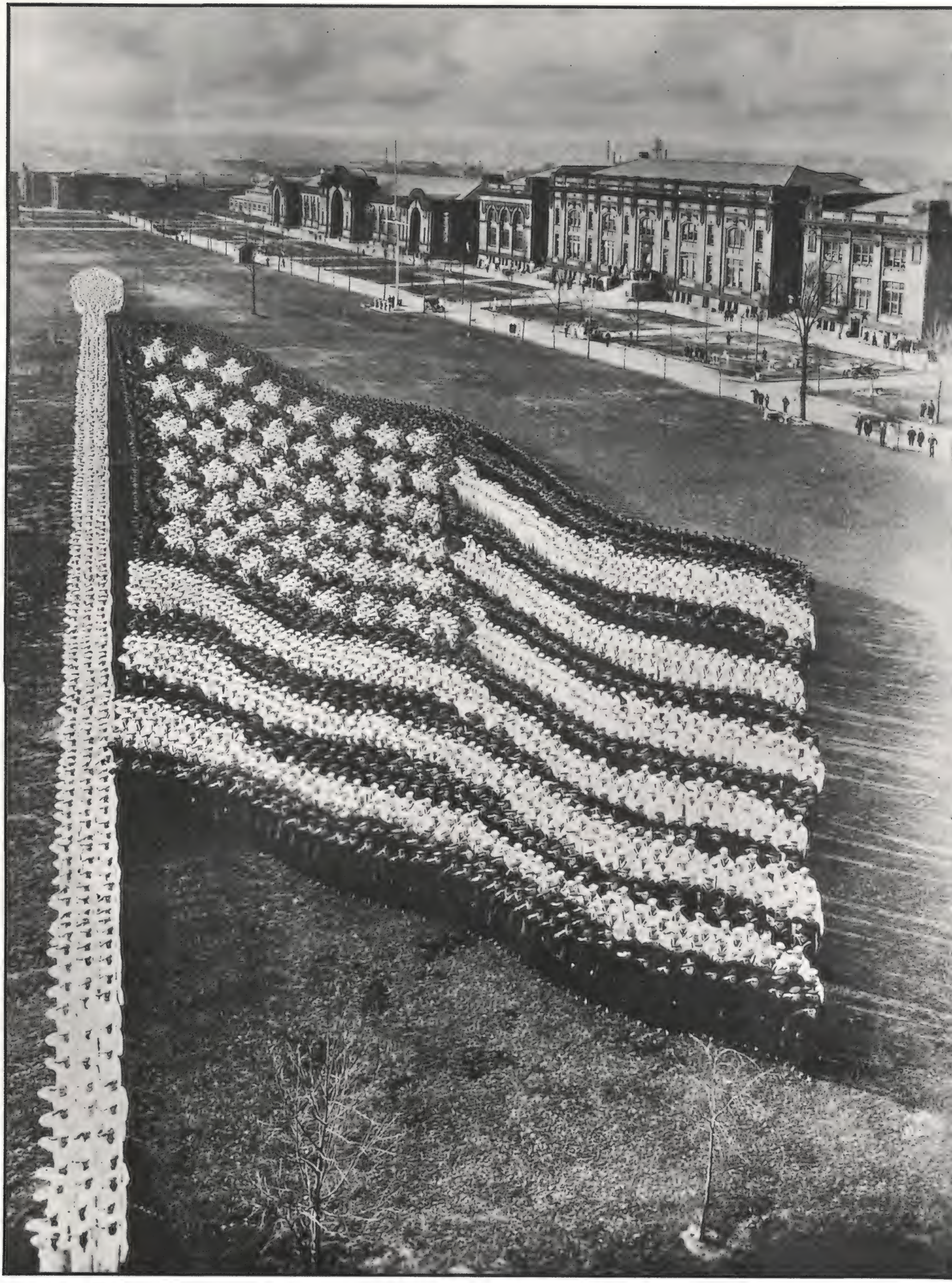
Mob to mosaic, and back again

Shortly after World War II, a panoramic photographer from San Antonio named Eugene O. Goldbeck put the "living insignia" idea in motion, recording the dismissal of his own human Air Force insignia with a movie camera. Run backward, the footage of the miraculous transformation of mob to mosaic became a favorite of newsreel audiences around the country.

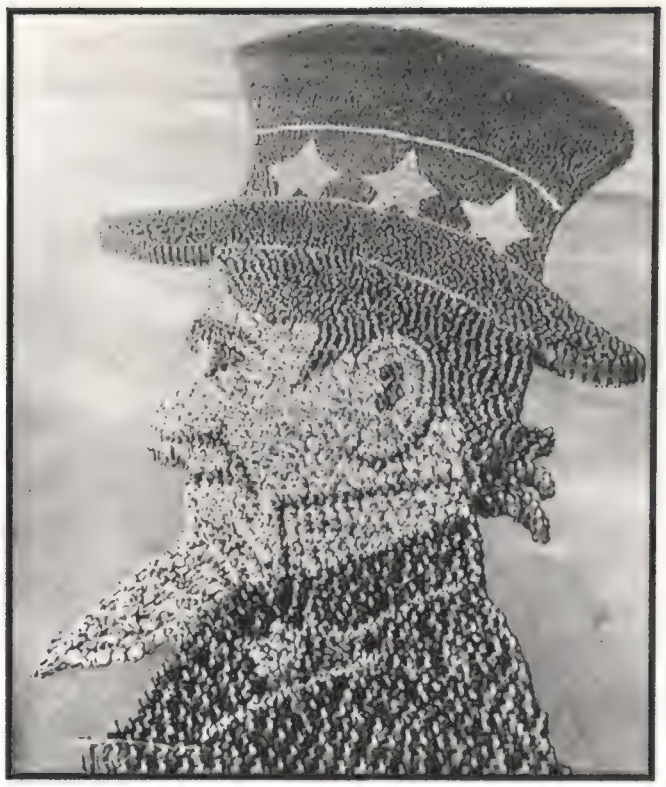
Today, patriotic formations like Mole's and Goldbeck's seem quaintly outdated. "In the past, people wanted to be part of the big picture. They believed in a national identity," says photography historian Grant Romer, director of conservation and museum studies at the George Eastman House in Rochester, New York. "Today, that's kept alive only in countries with monolithic social facades like China and North Korea, where people in stadiums hold up placards to form a human mosaic." For better or worse, he says, Americans today are too individualistic to be willing to lose themselves within a larger whole, especially when that whole is a manifestation of the state. "Besides," he says, "making a picture like that is hard work."

The Human Liberty Bell: 25,000 officers and men; Camp Dix, New Jersey

The Human Statue of Liberty: 18,000 officers and men; Camp Dodge, Iowa



The Living American Flag: 10,000 men;
U.S. Naval Training Station, Great Lakes, Illinois



The Living Uncle Sam: 19,000 officers and men; Camp Lee, Virginia

The YMCA Emblem: 8,000 officers and men;
Camp Wheeler, Georgia

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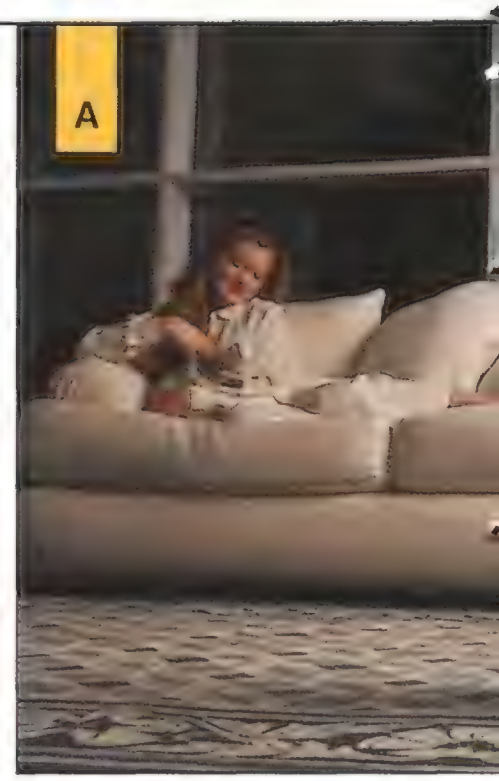

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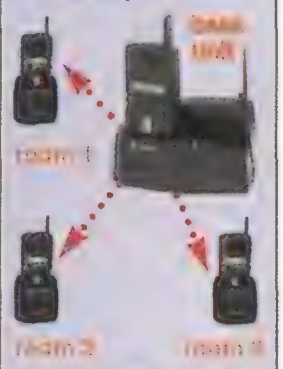

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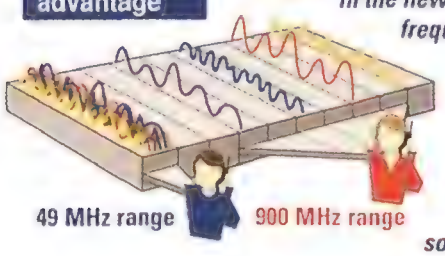

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By Jack Hope

Urban New Agers have taken over the art of dowsing

Once just a way to find water, this rural practice is now used to test both food and dinner partners—can you believe it?

Ann Lieb uses hers over a dowser's chart to rate both the enjoyment and potential benefit of rental movies.

At Avenue M Video, in the Midwood section of Brooklyn, attorney Ann Lieb is on a routine mission: selecting a handful of weekend videotapes for her husband, herself and their three children. Her method of selecting just the right videos—by "dowsing" them, much as a gnarled New Englander might dowse for underground water—is sufficiently odd, however, even by New York City standards, that she attracts puzzled glances, amused smiles and prolonged stares.

After pulling down a half-dozen tapes and lining them up on a countertop, Lieb plucks from her purse a printed "dowser's chart" and a tiny pendulum: a half-ounce fragment of turquoise suspended on a five-inch length of nylon string (above). She places the numbered, semicircular chart at the base of each videotape, dangles the pendulum, first over the tape, then over the chart, and asks two questions: "Tell me, please, on a scale of zero to one hundred," she begins, addressing her pendulum matter-of-factly, "just how much would my little Aliza enjoy *Barney's Imagination Island*?"

Slowly, the pendulum begins to swing elliptically to the right, seemingly on its own. It moves steadily from the number 50, at the center of the base of the chart, up past 60, 70 and 80 and hovers, finally, at a high of 85.

Promptly, Lieb arrests the instrument with her left hand and brings it back to a stationary position. "All right, now please show me how much little Aliza would *benefit* from watching this tape, how much it would raise her social awareness, brighten her chakras, elevate her *chi* energy, and like that. And please let's try to be a little quicker about it," she admonishes the instrument.

Again the pendulum begins to swing. (Is Lieb doing this herself? I can't detect any initiating movement in her hand although I've heard of a parlor trick that produces similar results with a suspended weight.) This time the swing is to the left, down past 30 and 20 to a dismally low reading of 12.

Lieb laughs. "I guess that's just about what you'd expect." She plunks the cassette up on the "reject" pile and goes on to the next one: "Please tell me, on a scale of zero to one hundred, how much my husband, Mark, and I would benefit this weekend from watching *Serial Mom*." And in an aside to me she confesses: "I don't even have to dowse this one for 'enjoyment,' because I just *love* Kathleen Turner!"

In an apparent surprise for Lieb, the pendulum moves quickly downward to 10. "That's odd," she says, frowning. "I've never seen Turner in a bad movie. There

For New Age practitioners, the hand-held pendulum has become the instrument of choice in any situation.

Beginning dowsers try their hands at techniques used to find water at the Mid-South Dowsing Conference in Fayetteville, Arkansas.

must be something very wrong with this film." *Serial Mom*, too, goes on the reject pile.

After 20 more minutes we depart the store with *The Joy Luck Club* for Ann and Mark (it gets a 78 for "enjoyment" and an amazingly high 76 for "social and spiritual benefits"), *Thumbelina* for Aliza and *Mighty Ducks II* for the whole family.

It's on, then, to Nature Food Centres, where Lieb dowses vitamin pills for her kids: "On a scale of zero to one hundred, show me how much my daughter Tamar would benefit from ingesting one Love Bites a day."

It's time-consuming, this shopping-by-dowsing. But, Lieb says, she uses the method almost daily. She's used it this week to tell whether her auto mechanic was lying about the "four oil leaks" in the engine of her Oldsmobile and to determine to which partner in a law firm she should send her resumé. And if I think *she's* weird, I should meet some of the hundreds of other New Yorkers who dowse for everything from stock market buys to whether they should respond to an ad in the "Personals."

She respects science, Lieb hastens to add, and she's not at all a New Age type who claims to see mystical energy oozing from every crystal of quartz. But in her gut, she's felt the method to be straightforward and pretty much foolproof. Everything in the Universe has an individual energy, Ann says; by using a dowsing instrument and by asking it *just the right questions*, a person, almost any person, can learn to pick up on the goodness or badness, the truth or untruth of those energies.

The art of dowsing (still called "divining" or "witching" in some circles) dates back at least to Moses and Aaron, who used "the rod" to bring forth water from rock. Dowsing for a variety of purposes ebbed and flowed around the rim of the Mediterranean; in the late Middle Ages, Germans and Britons employed the technique, for finding underground mineral deposits.

In its American incarnation, until very recently, dowsing was used 99 percent of the time to locate underground water for rural families and livestock. It was practiced almost exclusively by country males tending to be upwards of 50, who, using a freshly cut, Y-shaped stick of willow or fruitwood (apple, pear, peach), obligingly found drinking water for friends and neighbors.

If you needed a well dug or drilled, the dowser came, strolled around your premises for an hour or so gripping his stick, palms upward. Mysteriously, at some precise point, the stick twisted suddenly and inexorably in the dowser's hands (so strongly, he often said, that it blistered his palms) until its butt pointed downward at a spot on the ground, and your dowser then said, confidently, "Drill here."

Nobody knew the origin or the method of the dowser's skill. And if you asked, he would likely say something like my own family's successful well dowser, George Everett, did in 1960: "A fruit stick wants water."

All this has changed radically within the past two to three decades. How radically, I discovered at a weeklong annual convention of the American Society of Dowsers

Jack Hope, who divides his time between Manhattan and the Catskills, wrote about the keeping of pure and hybrid wolves as house pets in June 1994.

Plastic has replaced the traditional fruitwood Y-rod, and these days the dowser is just as likely to be female as male.

Inc. in northernmost Vermont. There, equipped with plastic "Y-rods" (hardly anyone uses wood anymore), copper "L-rods" and designer pendulums (clearly the preferred dowsing instrument of the '90s), some 900 practitioners from across the nation overflowed the dorms on a small college campus and spilled out into the hotels, motels and bed-and-breakfasts for 20 miles around.

The American Society of Dowsers (ASD) was founded in 1961 by a small group of male water-well dowsers, mostly from New England. Its 34th annual get-together, however, attracted a crowd that contained nearly as many women as men, and far more urban and suburban types than country souls who, to my amazement, had little or no interest in dowsing for water.

The ASD holds a preconvention water-dowsing school, but of the actual convention's more than 60 lectures and seminars, only one—poorly attended—dealt with water wells. The rest, delivered to packed and eager audiences, bore titles such as "Dowsing for Indian Effigy Mounds," "Handwriting and Dowsing—a *Feng Shui* to Your Consciousness," "Dowsing the Universe Through Sound," "Dowsing and Emotional Well Being," "Dowsing the Depths of Human Reality," "Communication with Animals Through Dowsing" and "Deviceless Dowsing: Listening to the Trees."

Even offstage the mostly sincere and ebullient conventioneers could not refrain from twirling and twisting with their instruments. They dowsed their scrambled eggs (to see if they'd been laid by organically raised chickens), their after-breakfast pears and apples (to see if they'd been sprayed with insecticides) and even one another to see if he or she might make an engaging dinner partner, or more.

As a supposedly objective bystander, I tried to view all this from afar. But ever-eager conventioneers did me the unasked-for favors of dowsing my marriage, the future of my literary career, and the color and dimensions of my personal aura—once with a Y-rod, thrice with pendulums and once with a hand-held "aurometer," available in the ASD bookstore for $69.95.

I was foolish enough to mention my previous night's sleeplessness (it was 90 degrees F and there was no air-conditioning) to a well-meaning corridor mate. He immediately pendulum-diagnosed my problem as having "seven noxious streams" flowing in the earth underneath my bed, which he offered to dowse away the next night. Once I felt fortunate to escape with my innards intact from another dorm mate, a Florida psychic surgeon who was bound and determined to remove a host of "blockages" he dowsingly perceived in my lower intestine. (He offered the surgery free of charge.)

I did solicit the help of two dowsers: Leroy Bull, of Doylestown, Pennsylvania (he finds water, and more, at a distance), and forensic dowser Ginette Matacia, from Springfield, Virginia (she locates missing persons). Both helped me find things I'd lost.

Bull, just arrived on campus, responded to my panicked pleas to find my lost notebook (containing a third of the notes and quotes for this article) by whipping out his Y-rod and turning in a full circle. "It's not outside on a wooden table where you fear you left it," he said, rapidly. "It's inside, near the cafeteria, in a corridor

Filippino Lippi (1457-1504) depicted Moses bringing water forth from the rock to the thirsty Israelites. Was Moses the first dowser? The origin of the practice is unknown; most date its popularity to the Middle Ages.

where you dropped it when you ran in from the thunderstorm this afternoon. It's only about 150 yards from where we are right now."

Bull seemed confident, but I surely wasn't. I retraced my afternoon's path, first to the outside table, then inside, through the cafeteria and into a hallway that led to the ASD bookstore. The notebook was on my right, on the first floor in the hallway.

Ginette Matacia guided me, post-convention, in finding a long-lost green insurance folder labeled "Cab Accident" containing a police report, insurance claim forms and the statement of an eyewitness who had seen a taxi bash my parked car. Twirling her brass pendulum in Virginia, she posed questions over the phone to me in my New York apartment:

"Your work area is a complete mess, right?" she began. "There are folders and paper strewn all over the place?"

"Right," I confirmed.

"But you have two file cabinets that are almost neat? One's upright with drawers? The other's one of those open, rolling things with wheels?"

"Yes."

"Look in the open file," she instructed. "Except . . . I'm getting the color red. Are you sure your missing stuff isn't in a red folder?"

"It's *green*," I reminded her. "And I have already searched through that file, completely, three times."

There was a pause. "Humor me and look again," Matacia finally said. "But look for red. You've got just one red folder in that file. The color will catch your eye, and the green folder will be right next to it."

I looked. There was indeed just one red folder, and it did catch my eye. If I wanted to be a stickler, I suppose I could point out that the green Cab Accident folder I'd been seeking for seven weeks wasn't "right" next to the red one: there was an empty manila folder between the two. But, not bad, I thought, from 300 miles away.

Nobody knows how many dowsers there are in the United States. Part of the problem, of course, is that it's increasingly unclear what "dowsing" consists of these days. What is clear is that there is a new passion for the ancient art, and that it is being taught and learned through dowsing mentorship, $80 suburban-weekend seminars and 75 regional chapters of the American Society of Dowsers. The dowsing community is persuaded that there are likely from one million to two million people out there—some of them admittedly secretive about it—regularly doing something or other with a rod or a pendulum, whether selecting a film or a past life.

"We try to encourage our new people to get a firm foundation in water dowsing," says former ASD president Gordon Barton. "But we have to recognize what

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the American public wants. If all we offered was traditional dowsing, we know we'd lose a large percentage of our new membership."

The decline of American interest in dowsing for water is predictable. We are no longer a society of ruralists and farmers with a need for individual water wells. For most of us today, the need for drinking water is satisfied simply by turning on the faucet. Nor is the recent female infiltration of dowsing all that amazing, given the legal and social crumbling of the barriers erected by formerly all-male institutions.

Dowsing for spiritual balance

What's puzzling is the sudden interest in the New Dowsing as an apparent answer to a multitude of practical, personal and even spiritual questions. Contemplative dowsers give very similar explanations.

"It's because each and every one of us today feels something lacking inside," says Ann Lieb. "We know life consists of more than we can perceive with our five senses; it has dimensions accessible only by intuitive or spiritual means. Dowsing gives us that access."

"The time is right for it," says Gordon Barton. "Many people today see dowsing almost as a new religion. But if that's so, it's also an available religion. Anyone can learn it. You don't have to go off to a cave to meditate."

"Let's face it," says Dr. Wayne London, longtime dowser and former research associate in psychiatry at the Dartmouth Medical School, "the secular-scientific community we Americans have worshiped the last 50 years is bankrupting us spiritually. In large part that's because we've become, just as Einstein predicted, a community of closed-minded specialists. We don't have the human or spiritual or Earth-connected balance of past societies."

London is not alone in the conviction that dowsing warrants serious attention. "Scientifically, we have no idea what dowsing *is*," says Elizabeth Lloyd Mayer, a member of the psychology faculty at the University of California at Berkeley and the psychiatry faculty at the University of California at San Francisco, as well as being an analyst at the San Francisco Psychoanalytic Institute. "But my encounters with dowsing have opened my eyes to a wholly new way of looking at what we call intuition. There's surely something here that should be seriously looked at and not be discarded as simply a sideshow." Mayer's interest in dowsing was fueled when a handmade harp stolen from her daughter was located by Harold McCoy, a dowser in Fayetteville, Arkansas. From 2,000 miles away, McCoy correctly identified a house in Oakland, California, where thieves had hidden it.

Nevertheless, arrival of the New Dowsing has created its share of anguish within the dowsing community. It is by no means universally embraced by traditional dowsers who refer to it—never in "dowsing public" but often in private—as "voodoo," "soft-core," "find-a-husband," "feel-good" and "la-la-land" dowsing.

The animosity relates partly to the loss of stature by water-well dowsers. But it relates in greater part to the dowsing world's uneasiness over the seemingly undisciplined, unscientific and often downright goofy face the New Dowsing puts on dowsing in general.

Whereas traditional dowsers often worked (and work) inconspicuously, free and in their spare time, there are today thousands of full-time New Dowsers, some of whom hang out shingles declaring themselves specialists in everything from health to love to career paths to happiness, and who charge their vulnerable clients substantial sums for dowsed advice.

"There's nothing false or deceptive about dowsing per se," says New York City dowser Nick Samardge, president of the Manhattan ASD chapter. "But what the public needs to know is that, as in any field, there are good dowsers, so-so dowsers and bad dowsers. And then there are a handful of self-serving and self-deceived dowsers who are a threat to their clients and themselves. They

Harold McCoy wields his pendulum over a plan of Fayetteville to determine flow of underground water.

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Photographer Nick Samardge, an "informational dowser," finds noxious rays in entry of his apartment.

come on heavy with doom and gloom in your life and then offer to repair it at $60 an hour over the next six months to a year. If your dowser is one of these, run."

It used to be, when water dowsing predominated, that practitioners offered a kind of electromagnetic explanation of their art. But now that most of dowsing's implements are made of synthetics, many of its targets are nonphysical, and its participants use or claim to use their instruments to dowse situations as far as 5,000 miles or five lifetimes away, the electromagnetic hypothesis doesn't stand up.

Instead, today's dowsers tend to refer to the source of their power with less physical and more mystical terminology. Depending upon their backgrounds they may describe it as a "universal force," as a Jungian kind of "superconsciousness" or as intuition.

The relationship between dowsing and established science has always been distant, mutually suspicious. The birth of the New Dowsing makes it more so. "The fact about dowsing is, it's hard *not* to find water under most of Earth's surface, provided you drill deeply enough," says Jack Fischer, associate chief hydrologist for the U.S. Geological Survey (SMITHSONIAN, March 1983). "Admittedly, hydrologists are not as colorful as dowsers. We're scientists. We look for hypotheses and proof. We adhere to the laws of physics and chemistry to find and evaluate underground water. And we use procedures that enable us to do things dowsers generally don't. We locate water, but we also determine its quality, the rate at which it can be withdrawn and the impact its withdrawal will have on nearby wells and streams."

"There are no scientifically accepted studies that support the validity of dowsing," says Kevin McCray, executive director of the National Ground Water Association. "Whenever dowsers are subjected to scientifically rigorous tests of their ability, they score no better than you or I would. Probably the dowsers who are good at finding underground water are also good at reading the landscape and knowing where water might be. But then they're using normal, sensory cues, not the extrasensory means claimed by dowsing."

Dowsers retort that Earth's surface is by no means uniformly underlain by groundwater. They say there are many good dowsers who will not only site a well but accurately forecast the quality of the water, the impact the well will have on surrounding wells, and how far down a driller will have to go.

To put dowsing to a modest, quantifiable test, I met again with Leroy Bull in a suburb of Stroudsburg, Pennsylvania, to dowse a water well at the nearly finished home of Carole and David Strodel. Once on the premises, Bull went promptly to work, posing questions to his Y-rod. "Please show us," he asked the rod, as he consecutively faced the four directions of the compass, "which way to go to find a vein with the largest volume of potable water at the least possible depth below ground level."

The rod dipped enthusiastically toward the south, and Bull strode swiftly in that direction, walking roughly 80 feet down into the still-unpaved gully of the driveway and up onto a narrow ridge. There, in only two more strides, the tip of his instrument swerved dramatically downward toward the earth. (Could he be doing this with unconscious movements of his fingers, I wondered?) Bull then scuffed a small spot in the leaves, backed off three paces and approached the spot from a 90-degree angle as a cross-check. Again the Y-rod plunged downward, and he announced quietly that this was the place to drill. But there was more to it than that.

"Tell us, please," Bull asked the rod, "is this vein of water less than 200 feet below ground level?"

The rod didn't move.

"Is it less than 300 feet?"

Again, no movement.

"Less than 400 feet?"

This time the rod's tip dipped visibly downward in a yes, and Bull narrowed his questioning.

"Is the vein less than 350 feet?" No. "Less than 360 feet?" Yes. "Less than 355 feet?" Yes.

"All right," he said to the Strodels, who were anxiously standing by, "your driller will hit water at between 350 and 355 feet. Now let's see if it's enough.

"Will this vein supply more than ten gallons per minute?" (Generally, a flow of one gallon per minute per person is deemed adequate.)

"More than eight gallons?"

"Six gallons?"

"Four gallons?" The rod dipped downward.

"More than five gallons?"

This time the rod tip began to dip but halted midway.

Bull nodded. "OK. A flow of a little more than five gallons per minute."

Asking his Y-rod a rapid series of yes-no questions, Bull also determined that the well would not have a negative impact on neighbors' already-drilled wells, that it would contain no heavy metals, PCBs or industrial contaminants and that it would yield water with a low mineral content, so the Strodels would not have to invest in a water-softener.

As a bonus, which is apparently becoming standard among dowsers, Bull also informed Carole and David Strodel that their wooded homesite emanated no "geopathogenic rays" that might make the family ill, that it contained neither buried cash nor historic relics or documents worth more than $1,000, nor any Native American burial grounds or otherwise sacred sites.

The entire process, including the fringe benefits, took no more than 35 minutes. The Strodels seemed happy with the quick, promising results and gladly paid Bull his $75 fee. I was delighted with the specificity of his predictions because I knew that two weeks hence, I could check them with the driller.

Two weeks later, however, Carole Strodel confessed to me in a phone call that she and her husband had finally decided, at their contractor's insistence, to drill their well not where Bull had specified but in an entirely different location, only 20 feet behind the house.

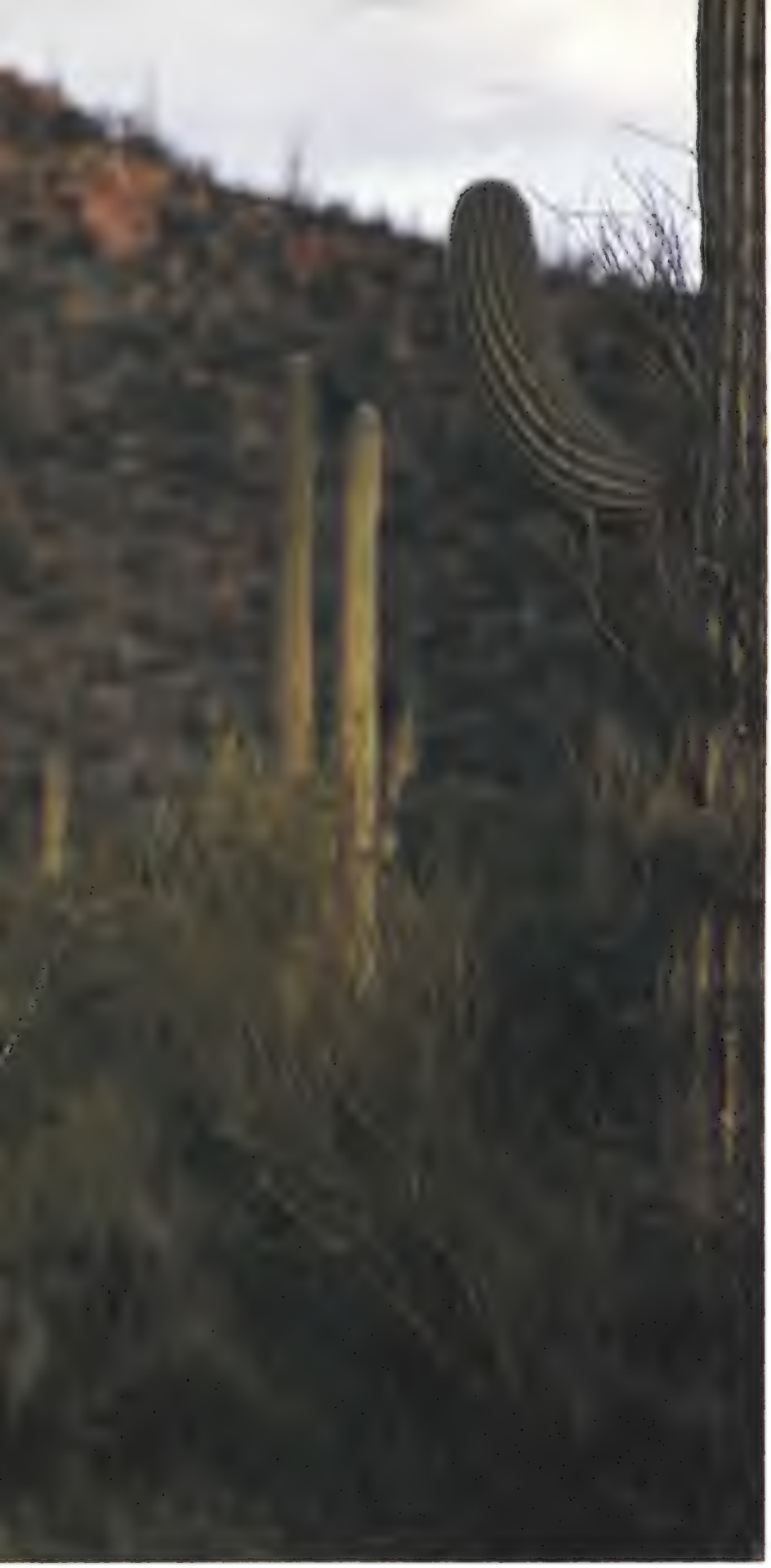
I was devastated. But when I phoned Leroy Bull to tell him of the disappointing nonresults, he chuckled good-naturedly. It often happens this way, he said. It's no longer like the old days when farm neighbors desperately needed a perfect well, had only limited funds to find and dig it, and thus put their faith fully in their dowser. And he expressed another thought: "I think I better start charging more for my services."

Leroy Bull uses a Y-rod to dowse for the optimal location of a new well at a development in Doylestown, Pennsylvania. When he finds it, he will take the owners to water, but he can't make them drill there.

By Susan Hazen-Hammond

A giant shrugs off vandalism, poaching, tales of its demise

The Sonoran Desert's mighty saguaro cactus is the living embodiment of the Southwest, a 'charismatic megaplant' that people care about



Damage and decay have left this ten-foot specimen looking eerily like Gumby, the cartoon character.

One sunny February day several years ago, David Grundman, 24, a maintenance worker in Phoenix, Arizona, pulled on his Levis and boots and set out into the desert with a 16-gauge shotgun. That day, he saw all sizes and shapes of saguaro, the largest species of cactus in the United States. Some had so many bird cavities, rodent tunnels and bullet holes in them that their trunks and arms seemed made of spiny, green Swiss cheese. A few oozed a black bile that smelled like vinegar.

Grundman picked up his gun. We will never know what he was thinking. He shot a small saguaro in the trunk so many times that it thudded to the ground. "The first one was easy!" he called, according to a witness. Then he aimed the shotgun at a saguaro four times taller than he and fired. Before the ringing in his ears had stopped, a four-foot spiny arm, severed by the blast, fell on Grundman, crushing him.

Grundman's death by flying cactus quickly became the lead story in the unwritten book of saguaro lore. Years later, as I crisscrossed the Sonoran Desert—the only place on Earth where saguaros grow—scholars, desert rats and urbanites were still talking about the "saguaro that fought back."

Even without a macabre twist, the death of a giant saguaro makes the news. In January 1994 the *Arizona Republic* devoted nearly half a page to the demise of "Old Granddaddy," a 44-foot-tall, 50-arm saguaro estimated to be 300 years old.

"People identify with the saguaro. It's a symbol," says Raymond Turner, a retired biologist. Around the world the celebrity cactus has become a symbol not just of the Sonoran Desert but of the West and the entire United States. And although thousands of other plants, including more than a hundred Sonoran Desert species, are at greater risk for extinction, no other cactus and few other plants have produced greater or longer-lasting concerns about their survival.

All this for a plant with such a small range that it grows only in certain parts of the Sonoran Desert: in highly specialized microclimates in Arizona, in the Mexican state of Sonora and on the fringes of southeastern California. In the United States, the saguaro typically likes rocky soils with good runoff, on south-facing slopes. Again and again throughout the Sonoran Desert, stands of the stately cactus thin and stop, then reappear many miles away.

Saguaros are thought to have established themselves in their current range about 11,000 years ago. One of the legends of the Tohono O'odham peoples says the first one was created when a girl sank into the earth and rose back out as a giant cactus. Ever since, saguaros have been an essential part of desert dwellers' lives.

The cactus flesh, heated over coals, soothed rheumatism's pains. The flowers produced a sealant. The juice, turned to vinegar, allowed artisans to etch seashells. When a northern flicker or Gila woodpecker pokes through the waxy epidermis to make a nest, the cactus forms a callus. For centuries humans have harvested these callus-covered hollows, called boots, from dead saguaros and used them as containers. They have used the woody ribs to make shelters, tools, furniture, toys, splints and ceremonial objects.

Perhaps the greatest gift of the saguaro, however, has been its fruit. One evening late in June, when the sun

was about to set and the temperature had drifted down to 105 degrees F, I rendezvoused with Stella Tucker, a Tohono O'odham woman who lives in Tucson but moves into the desert each June during the harvest. We met at her ramada, an open-air shelter at a harvesting camp that she took over from her great-aunt, whom she calls her grandmother, according to O'odham custom.

The fruits keep her busy. Evenings and early mornings she harvests. For five hours during the hottest part of the day, she simmers saguaro juice over a mesquite fire until it turns into a thick, reddish-brown syrup that tastes like molasses. She spreads fresh pulp out to dry; before she can make jam from the dried pulp, she has to pull the seeds loose. Although the fruit is only a couple of inches long, the seeds are so tiny that one fruit contains two thousand of them. "My grandma used to make porridge out of the seeds," Tucker said. Sometimes Tucker still makes porridge or candy. Sometimes she uses the seeds for chicken feed.

That evening, Tucker hefted a 16-foot-long harvesting tool onto her shoulder. It consisted of two overlapping ten-foot saguaro ribs lashed together, with a crosspiece of wood at one end. Saguaro juice had stained the crosspiece a deep red.

Tucker and I and two young visiting relatives set out through a grove of prickly pear, jumping cholla and saguaros. In the soil a foot beneath us, each saguaro spread its roots in a circle wider than the cactus' height, waiting like a concealed net to harvest the summer rains. A young saguaro can lose 80 percent of its body fluids and survive. These had lost less, but after months of not having replenished the water stored in their pleated trunks, the pleats had pulled together like closed accordions.

The saguaro begins blooming in late April, in the desert's driest season, attracting birds and other pollinators, including bees and bats. The trumpet-shaped white flowers open at sunset and wither by the following afternoon. Pollinated flowers metamorphose into fleshy fruits about three inches long, which slowly redden as they ripen.

On this June evening, a crown of 20 or so fruits and a

The blossoming of a saguaro (at top) is followed by the development of fruits (above), which Stella Tucker and her niece (left) harvest with a cactus-rib pole.

few late-blooming buds decorated the end of each arm and the tops of the central trunks of many of the cacti. We stopped at one that rose ten feet above us. It lacked arms, but its trunk wore a wreath of fruits. Most saguaros flower for the first time by age 50 but wait another 25 years or more to grow arms. This one was probably younger than 75, not yet halfway through the usual life span of 150 to 200 years.

While one of the girls held a bucket high, Tucker positioned the harvesting pole and tugged. Fruits came flying down, one and two at a time. Those that missed the bucket splatted on our shoulders, heads and arms. "It's raining," Tucker laughed. "That's what my grandma used to say."

Using her thumbnail, she slit a fruit open and handed me some pulp. "In the old days people used the fruit to help quench thirst," she said. Juicy and sweet, it tasted like a cross between a watermelon and a fig.

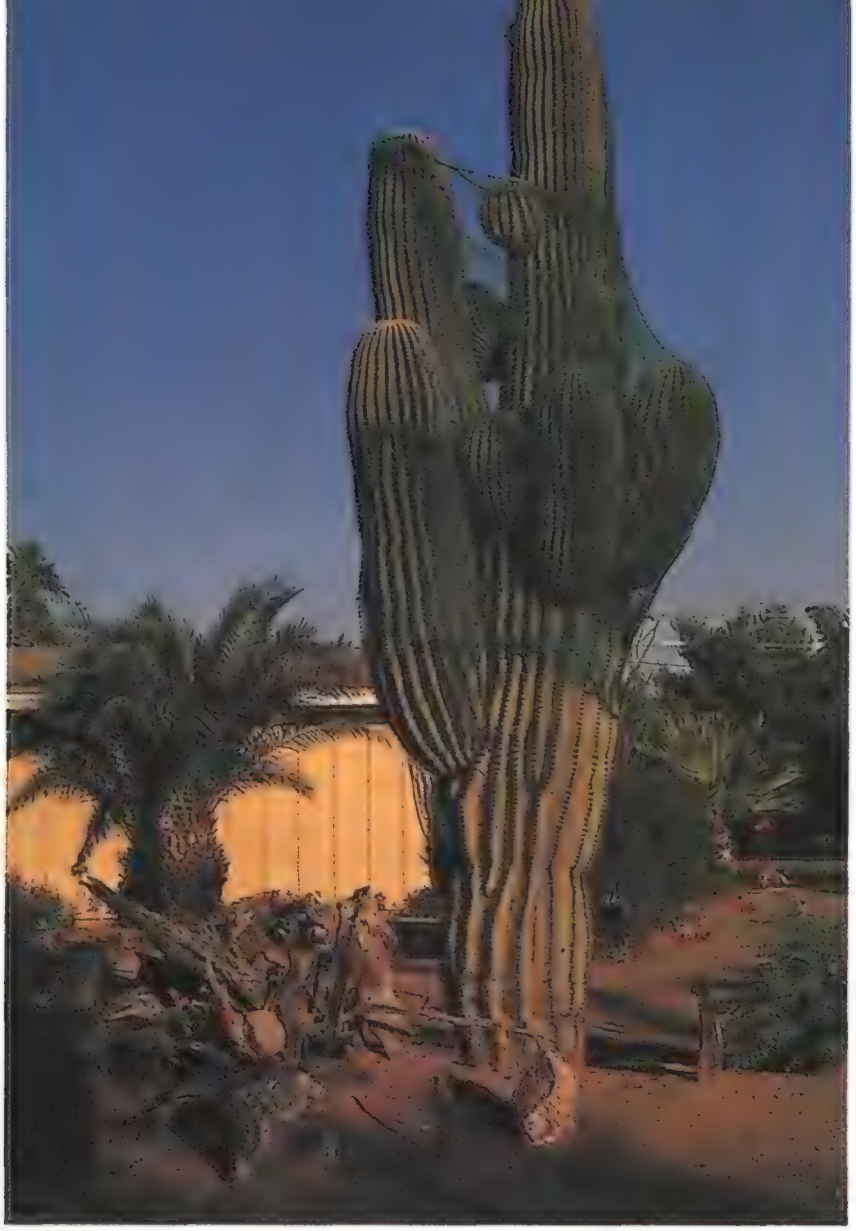
We moved from plant to plant until the bucket grew heavy, although less than half full. As we walked back toward the camp in the twilight, Tucker said, "We O'odham people treat our saguaros as people. We consider them as people. We consider them with respect."

Like human beings, the saguaro (*Carnegiea gigantea*) is the only living species in its genus. And like us, it is subject to endless stresses. Its vulnerability begins with its reproductive patterns. In a century of blooming, an individual saguaro may produce 40 million seeds. But often only one will develop into a mature plant that outlives its parent.

It takes two heavy summer rains within five days of each other to germinate a seed, and the desert environment is so austere that frequently 99 percent of the seedlings die within one year. Most young plants need two or three consecutive years of good summer rains followed by mild winters to become established. At three years, the cactus is still less than half an inch high.

Saguaros that survive usually do so because chance has sown them beneath a nurse plant, typically a paloverde, mesquite or ironwood tree, which shades them from the summer sun and creates a canopy of warmer air in winter. Earlier in this century, when woodcutters

Damage is inflicted by humans (top) and animals: an elf owl (above) avails itself of a woodpecker cavity. Death follows black ooze of bacterial decay (right).



Plump with water, a 20-footer in a Scottsdale garden is protected from hole-drilling birds by netting.

chopped down thousands of desert trees, they interrupted the saguaro's life cycle. So did grazing cattle. In some areas, including what is now the east unit of Saguaro National Park, virtually no saguaros survived infancy for more than half a century.

Woodrats, burrowing insects, jackrabbits, flickers and other animals cause damage in their search for food, shelter and water. The nest of the northern flicker increases the cactus' vulnerability to frost damage in winter by creating an interior pocket of icy air.

Lightning strikes saguaros directly, and it also starts fires which, fueled by non-native grasses that have invaded the desert, roast thousands of the cacti at a time. High winds topple the top-heavy plants. Housing developments eat their habitat.

In the northern part of the saguaro's range, including the areas near Tucson and Phoenix, the biggest killer, along with fire, is cold weather. The youngest and oldest plants are the most vulnerable. If there is an overnight freeze and temperatures stay below 32 F the next day and following night, many of them will die, often not right away but in years to come. But no single fact about the saguaro has attracted more attention or caused more concern than bacterial necrosis, a condition said to have killed Old Granddaddy and many thousands of others.

One blistering afternoon, Ranger Stanley Lawhead, manager of the visitors' center at the west unit of Saguaro National Park, took me on a tour. With elevations from about 2,200 to 4,700 feet, the west unit runs from the midpoint to the top of the cactus' natural range. In all directions, thousands of them climbed slopes or stood next to dry arroyos. No two looked exactly alike. Only one resembled the clichéd two-arm photograph. A few old-timers rose armless, like telephone poles, as saguaros often do in the drier, western edge of their range in northwestern Sonora and near the Arizona-California border. A few others had nearly two dozen arms, which is more common in the cooler, wetter parts of the range in eastern Arizona. One had spread at its top into a fan shape called cristate, a form so rare it reportedly occurs in only one of 200,000 specimens. The arms of many of the cacti had twisted and sagged following winter freezes.

We arrived at one that was clearly in trouble. The old ironwood tree that had nurtured the cactus in infancy was still growing six inches behind it but couldn't pro-

The author wrote on horny toads in the December 1994 issue. Her fifth book, Timelines of Native American History, *will be published by Berkley early next year.*

Behind the charred victim of an earlier blaze, fire marches across the desert on the outskirts of Phoenix.

Young and middle-aged (with arms) plants climb the steep terrain of Arizona's Saguaro National Park.

tect it now. Flesh had fallen away in places, and the cactus' bare ribs showed through. Several arms had broken off; those that remained had produced no flowers.

"The question is, why is this particular one dying?" Lawhead asked. "It's like people. Why does one have cancer and another not? Sometimes there's no way to know."

A thick black liquid oozed, one drop at a time, from a gash in the trunk and formed a broad tarry streak that ran down its length. The air smelled like vinegar: the stench of bacterial necrosis.

When Saguaro National Monument was established in 1933 at what is now the east unit of Saguaro National Park, it was with the goal of preserving dense stands of towering, richly armed saguaros. Yet by the early '40s, those very same plants dripped the black liquid of bacterial necrosis and fell, limb by limb, to the ground.

Newspapers nationwide announced the coming extinction of the saguaro. Scientists tried to combat what appeared to be a fatal disease. Field biologists surveyed a swath of the Sonoran Desert that ran 200 miles north to south and 250 miles east to west, and they found bacterial necrosis throughout, sometimes in as much as 20 percent of the tall cacti. They reviewed the scientific literature and found accounts of the condition from as early as 1889.

In 1941 and '42 researchers cut down all affected saguaros in a test plot and disinfected and buried them. But others in the test plot continued to develop bacterial necrosis as often as those in untreated areas. In following years, researchers considered eliminating with pesticides the vector moth they identified as the cause. They injected antibiotics into the cactus, but nothing worked. Some scientists predicted the obliteration of vast stands by the year 2000.

Then, in the 1970s, two University of Arizona researchers, Warren Steenbergh and Charles Lowe, observed that bacterial necrosis occurred mainly in those saguaros that had experienced prolonged freezes and those that had been otherwise damaged. The fallen cacti in the east unit of the monument had been old, and because they were situated near the upper end of the species' elevation range, they had been hit especially hard by freezes.

Bacterial necrosis is not a disease, the researchers concluded. It is simply the natural decay of tissues that are already dying or dead. As Joseph R. McAuliffe, director of research at the Desert Botanical Garden in Phoenix, told me, "Bacterial necrosis is the consequence of death due to another cause."

Still, the myth of the vanishing saguaro persists, and

Cristates, saguaros with gnarled, fan-shaped tops, are said to occur only once in every 200,000 plants.

McAuliffe and other researchers continue to receive calls from journalists and worried citizens. Said McAuliffe, "Ninety percent of the country still seems to believe that the saguaro is disappearing from the Earth. It's not." He understands the concern, though: "People get excited about charismatic megaplants, especially about saguaros, because they have arms, just like people."

Betsy Pierson, a U.S. Geological Survey botanist at the Desert Laboratory on Tumamoc Hill in Tucson, has reached the point where she refuses to talk to reporters if they insist on writing stories that proclaim the species' demise. And like most other researchers, she has little patience with those who worry that epidermal browning, a condition in which the skin of the saguaro turns brown, will wipe them out if bacterial necrosis doesn't.

"Far from being some ominous result of ozone depletion, air pollution or ultraviolet rays, epidermal browning appears to be a normal effect of aging, exposure to high heat and periods of drought," she says.

The real issue, Pierson believes, is this: "Are sufficient new saguaros becoming established?" Today saguaro "recruitment," as it's called, is down in some places, up in others.

In the east unit of the national park, where practically no seedlings survived for more than 50 years, cattle no longer graze, woodcutters no longer chop. Nurse plants have reestablished themselves, and hundreds of young saguaros rise like columns on the hills. Barring killer freezes or other disasters, park visitors a hundred years from now will see fine, multi-armed saguaros much like the ones that stood in 1933.

One afternoon on Tumamoc Hill, as Pierson and I looked out over the 4,700 saguaros in her test plot, she said, "Nobody can say for sure at what point a saguaro is truly dead. Was it able to take up rains in the summer or not? And if it didn't take up water, is it still alive? Sometimes even saguaros that have blown down or fallen over will continue to flower."

No one has tried to census all the saguaros in the Sonoran Desert, and none of the specialists I spoke with wanted to be quoted regarding population estimates. Off the record, some said there are several hundred million. One suggested a billion.

Just because they are numerous doesn't mean they are safe, however. Vandals like David Grundman shoot them. Out near Saguaro Lake, east of Phoenix, I've counted more than 50 bullet holes in a single saguaro. Miscreants cut off the cactus' arms with chain saws, axes or machetes. In eastern Arizona, I saw one that had been pierced by an arrow. And many homeowners in Arizona and beyond, who wouldn't dream of shooting or mutilating one, want the stately cactus in their front yard.

In Arizona it's illegal to damage saguaros or to remove them from the desert, living or dead, without a permit. To reduce the century-old problem of cactus poachers, who steal saguaros from the desert and sell them for landscaping, permits are also required at nurseries, where saguaros with arms sell for more than $1,000 apiece.

All a poacher needs is 15 minutes

Investigators for the Arizona Department of Agriculture, sometimes called Cactus Cops, patrol the desert. One ferociously hot July day I rode with investigator Tom Rogers. A slight man with wavy hair and a graying mustache, he has driven nearly 50,000 miles on patrol in the past two years. "We don't know how many saguaros are stolen off public lands every year, but it's a significant number," he told me. "Part of my job is just to let people know the area is being watched."

On a dirt track in Pinal County, Rogers stopped the pickup, and we walked out to check a cristate saguaro he's been keeping his eye on. It stood untouched, but nearby there was a shallow depression that spread three feet across the desert floor. "Here's where someone dug one up illegally, months ago," he said. "What they do, they go down this deep—less than a foot—and cut through the roots and dig it up. It only takes about 15 minutes to get it on the truck."

Rogers pointed to the cristate. "I'm so glad they didn't get that fellow. Probably they knew it would get

them stopped going down the road. Or maybe they knew no nursery would touch it."

No matter how hot it gets, Rogers cruises all day with the window rolled down and the air conditioner off so that he can listen to sounds from the desert. That day we encountered no cactus pirates, but for mile after mile we passed saguaros that had been shot up, some so badly they had fallen.

One morning I went back to see the saguaro where Stanley Lawhead had showed me the black ooze of bacterial necrosis. The air still stank of vinegar. Dark liquid dripped like black blood from the cactus' side. Several more limbs had fallen. The wind blew through the needles of the remaining arm with a whispering sound. A few months more and all that would remain would be a skeleton of woody ribs standing like a ghost in the desert.

All around rose the next generation. Several were about 18 inches high, more than 20 years old. A few others, about four feet high, were older than 30.

At the edge of a runnel, beneath a creosote bush, I parted the brush, and there sat the smallest saguaro I'd seen in the wild. At six inches high, it was at least 12 years old. All the favorable factors were there—water, nurse plant, rocky soil, and good separation from both the dying parent and the animals that gather around mature cacti.

Betsy Pierson likes to say, "Young saguaros are only a promise. They're not a guarantee." But with luck, half a century from now this tiny saguaro will be a young adult, taller than you or I, sprouting white flowers.

Flexible ribs of long-dead saguaro form an austere arrangement that may stand for decades. Behind them, however, healthy individuals bode well for the future. Speculation on the icon's imminent demise is baseless.

By Richard Wolkomir

Shooting right for the stars with one gargantuan gas gun

At the Lawrence Livermore lab, researchers John Hunter and Harry Cartland want to train a behemoth barrel on the reaches of outer space

Hunter and Cartland, who are testing a smaller-scale supergun, envision the megalauncher of their dreams.

John Hunter is checking the controls of the world's largest gun, which he created from a relatively modest $2.8 million in research funds, along with scrounged parts and formulas jotted on pads. "Wait a minute," he says, puzzling over the switches. "Which one shoots it off?" He flips a toggle switch. "Not that one," he says. "Maybe it's this one . . ."

Hunter, tall and boyish, with a mop of straight black hair, looks as if he just galloped into town after branding longhorns. But he is a physicist, originally of the lepton and top-quark variety. Right now, he is standing in the control room of a Lawrence Livermore National Laboratory particle accelerator, hidden in the treeless hills southeast of San Francisco. But he is not here to study protons. The accelerator's scientists let him use a corner of their control room as a firing bunker for his big gun, set into a nearby ravine.

"Harry?" Hunter calls. "Which is the trigger switch?" Harry Cartland, a physical chemist and Hunter's partner in operating the world's biggest shooting iron, studies the console. "That one," he answers, pointing. "Oh, yeah," says Hunter, momentarily chagrined.

But he is irrepressible. Hunter is unsure about the gun's trigger only because he never does the actual firing. An engineer works the switches, including one that activates a siren to warn away jackrabbits. Hunter and Cartland watch the big gun fire on a video monitor. Nobody stands outside to watch because a mechanical flub, like a sticking vent hatch, could—and once did—set off a lollapalooza of an explosion. "Then you have a bomb," observes Hunter, amiably, like a cowpoke fondly recalling his last really good saloon brawl.

Mostly, the big gun goes off perfectly. Yellow flames fireball out the barrel, along with billowing smoke, as an 18-inch-long projectile thuds at 6,800 miles per hour into the sand-hill target and vaporizes into a miniature mushroom cloud. "It's very satisfactory," reflects Hunter, with a broncobuster grin. Even Cartland, the laid-back member of the team, smiles in appreciation of the big gun's bravura flashiness. This is cowboy science.

Still, even though the big gun can be enjoyed as a gargantuan cherry bomb, it is for serious research. In this

Set into a mountainside, the two-mile-long, hydrogen-powered cannon would thrust satellites and spacecraft into orbit around Earth—for a fraction of the costs incurred in conventional-rocket or shuttle propulsion.

Northern California ravine, Hunter and Cartland are perfecting a Wild West satellite and spacecraft launcher: they plan to shoot payloads into orbit. And they plan to do it for pocket change—compared with the stratospheric costs of space-shuttle or conventional-rocket launching. They aim to make outer space at least as accessible as Outer Mongolia. They want to see big orbiting laboratories carrying research staffs in the hundreds, and villages on the moon.

They climb down the hillside in a gentle rain to look over their big gun. It is called SHARP, for Super High Altitude Research Project. At the moment, however, instead of aiming at the sky, the gun stretches out horizontally in the ravine, aimed more or less toward the Golden Gate Bridge. "We refer to San Francisco as the 'impact area,'" Hunter jokes. Actually, the gun currently fires its projectiles into a sand mound. The gun is a weird-looking assemblage of steel pipes, railroad tracks, massive concrete buttresses and armor plates, as if Hunter had somehow blended an Atchison, Topeka & Santa Fe switching yard with industrial plumbing, and then added bunkers and tank traps from Omaha Beach. "This is a gas gun, sort of a big BB rifle—you pump it up," explains Hunter.

Of course, it is not so simple. And Cartland is already eyeing his colleague dubiously. It is as if brash Teddy Roosevelt had teamed up with coolly analytical Sherlock Holmes. Hunter, at age 40, a family man with four children, is the older and taller partner. But he is the impulsive one, firing off ideas and dashing off wild calculations, often on napkins, that have a way of proving to be dead-on target. Cartland, 37, compact and blond, is all sinew and muscle from scaling cliffs, running at high velocity, bicycling, swimming and scuba diving. "When I was in the Army, I had the perfect job at West Point, because besides teaching science, I led cadets on rock- and ice-climbing expeditions," he says. Whenever Hunter's impulsiveness reaches critical pressures, Cartland produces a calculator to run through the figures. It is good they function as an ad hoc system of checks and balances because they are heavily armed.

"This is the biggest gun ever, and some of our critics say we made it 20 millimeters bigger than we had to, just so we could say that," cracks Hunter. Another broncobuster grin. SHARP's barrel is about half the length of a football field and some 20 feet longer than the menacing cannon Saddam Hussein tested and threatened to unleash during the Persian Gulf War. A battleship gun is about 60 feet long; SHARP's barrel alone stretches 155 feet. The gun's first stage, which contains most of SHARP's inner mechanisms, adds another 270 feet.

The underlying principle is straightforward: inside, the gun compresses hydrogen to a pressure so high that, when released, it whooshes a projectile out the barrel. It is akin to blowing a spitball out of a straw. But on SHARP's scale, the technology involves some twists.

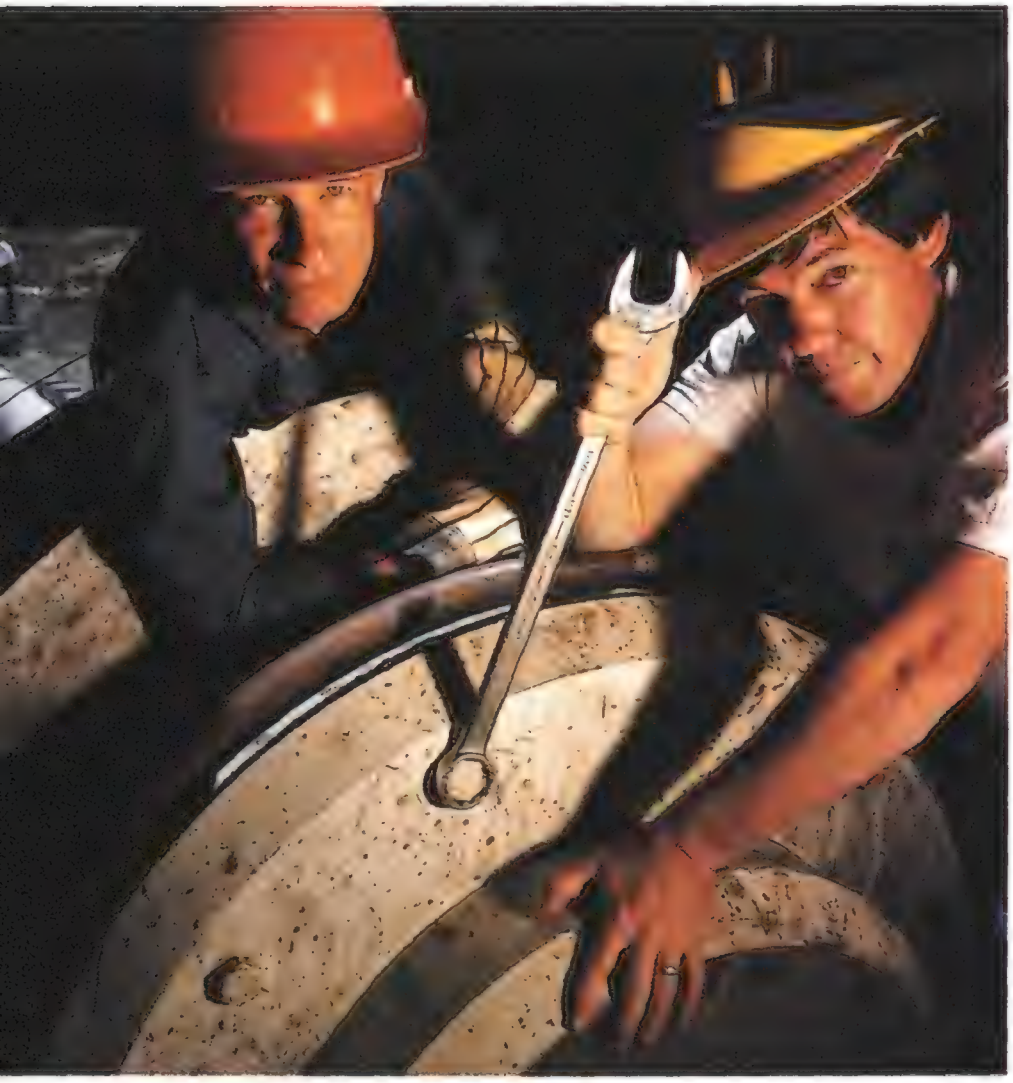
"Like the recoil," says Hunter. Fire a rifle or shotgun, and it kicks your shoulder. It must, because of Newton's third law of motion: for every action (the bullet speeding off) there is an equal and opposite reaction (the recoil). Absorbing the big gun's kick requires three massive steel counterweights, riding on railroad cars. When the gun fires, the railroad cars lurch backward, absorbing the recoil. But a shotgun or rifle recoils in only one direction. "When this gun goes off, we have things recoiling in three directions simultaneously," Hunter points out.

A touch of Rube Goldberg, yes. But that is good. Today's technologies inevitably seem to send electrons whizzing around on relativistic chores. To figure out what is happening you need Boolean algebra. The big gun, on the other hand, is pure hardware. That is its charm. It is solidly Newtonian, with levers and gears you can actually touch and get oil on your hands. It is blissful to listen as Hunter starts at his big gun's nether end, walking toward the muzzle and explaining as he goes what happens at the various stages.

First comes the "combustion section" (see pp. 88-89). Here, when an engineer in the control room flicks a switch, an electrical spark ignites methane, the gas given off by landfills. As the burning methane explosively expands, it shoves a one-ton piston forward. The piston pushes through a hydrogen-filled "pump tube," rapidly squeezing the gas ahead of it. In a split second, the hydrogen compresses to 30,000 pounds per square inch. The pressurized hydrogen then ruptures a seal and whooshes into the gun's evacuated barrel, where it pushes out the waiting projectile at up to 6,800 mph—nine times the speed of sound, or, as scientists would put it, Mach 9. An ordinary rifle bullet travels at approximately the speed of sound.

"Watch out for rattlesnakes—they thrive in here," warns Cartland, as he leads the way into a cave formed by the concrete buttresses supporting the gun's midpoint, known as the "high-pressure section." This is a critical zone because here the gun makes a right-angle turn. SHARP is L-shaped, an eccentricity designed to help Hunter reach his goal of launching spacecraft.

The gun's first stage, with its one-ton piston and hydrogen-filled pump tube, is massive. Elevating the entire contraption skyward to launch a spacecraft would require heavy lifting. And so Hunter connected the gun's barrel to its first stage at a right angle, on a pivot. That way, he can raise or lower just the relatively light-



Taking a hands-on approach, physicist Hunter adjusts a bolt inside the gun's high-pressure midsection, in the company of his partner, physical chemist Cartland.

During a test shot, a fireball of exploding hydrogen thrusts a scramjet (a type of high-speed engine) from gun's muzzle (far right). The jet trails a blaze of burning hydrogen fuel in its wake; jet's nose is visible at left.

weight barrel, while the heavy first stage stays horizontal. However, the pressurized hydrogen must turn a corner to get at the projectile in the barrel, which required some fancy figuring on Hunter's part.

One result of the L-shaped design—"It was a mistake at the factory," Hunter likes to joke—is that the gun recoils in three directions simultaneously. One 100-ton recoil absorber on tracks handles forces from the methane explosion. A matching weight at the pump tube's far end absorbs forces from the rushing hydrogen. A third recoil absorber on tracks, this one at the base of the barrel and weighing ten tons, handles the recoil from the launch of the projectile.

At one time, the world's biggest gun, with its recoil absorbers on rail cars, was just a concept floating in John Hunter's head. Hunter credits his cowboy ancestry with his taste for big ideas, wide-open spaces and new frontiers. One of his forebears, his mother's grandfather, was a renowned marksman on the Texas frontier. His father was a marine turned California cattle rancher and developer, but the cowboy gene pops up: his little brother, Hunter points out, "was probably the best roper in California some years back." Hunter figures he naturally gravitated toward his own era's frontier. Since he was born in 1955, the frontier was outer space. He applied to be an astronaut but failed to make the cut, primarily because of a scheduling problem in completing his PhD.

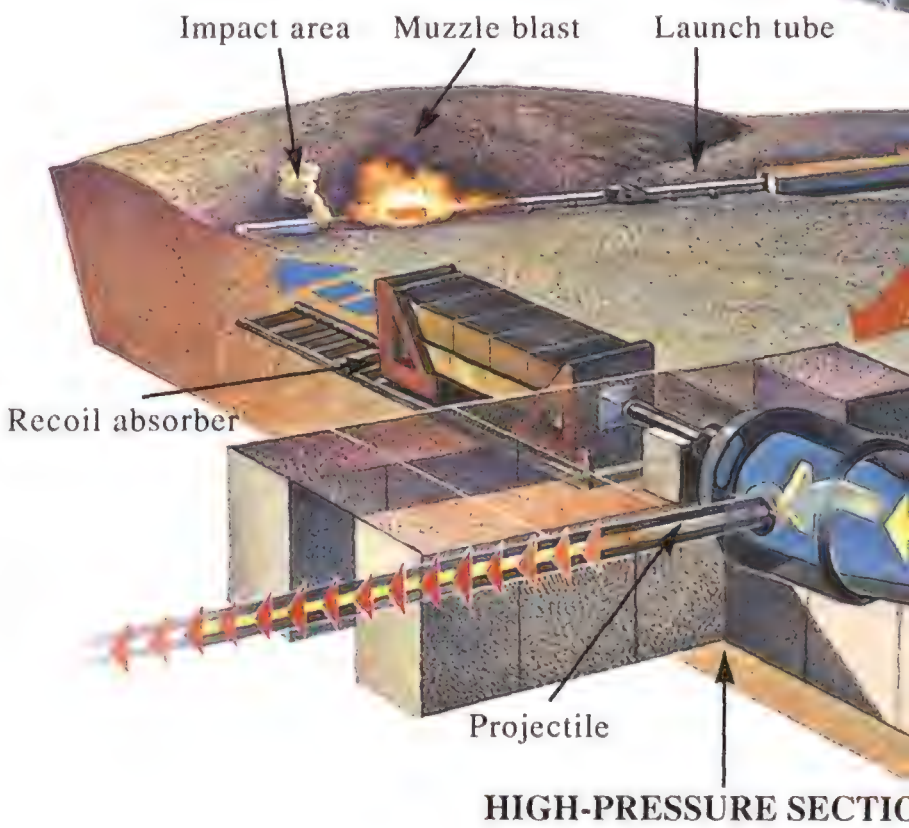
Hunter is addicted to playing tennis and basketball. "If it weren't for childhood allergies, I'd have become some kind of Neanderthal athlete, but I wound up reading books," he explains. "Also, my older brother is probably the world's best laser scientist," he adds, citing another influence. After completing a degree in physics at the University of California at San Diego, he spent a year hunting uranium along the Rio Grande. "That was so rough I was glad to go to graduate school," says Hunter. He began in plasma physics at William and Mary College, in Virginia, then switched to particle physics.

A newly fledged PhD, he heard that researchers at the Lawrence Livermore National Laboratory were thinking about laser-powered starships. He knew it was the place for him. What drove Hunter was the notion that unless somebody developed a new launch technology, the space frontier—where he wanted to go—would never really open up because launching materials into space with conventional rocketry is too expensive.

He began tinkering with designs for electromagnetic guns. "My designs required all kinds of whirring things, with grad students flying around, and I knew I needed to simplify," he recalls. Then, in 1986, at a cocktail party, somebody mentioned gas guns, which a few laboratories were using to shoot plastic pellets at high speeds. The

Frequent contributor Richard Wolkomir, who is based in Vermont, wrote most recently on Las Vegas' superhotels and on agronomist Jane Mt. Pleasant.

Stretching across a California ravine, the experimental supergun (above) is more than 400 feet long. Below, an artist's rendering details the gun's inner workings: first, methane gas ignites inside combustion section.



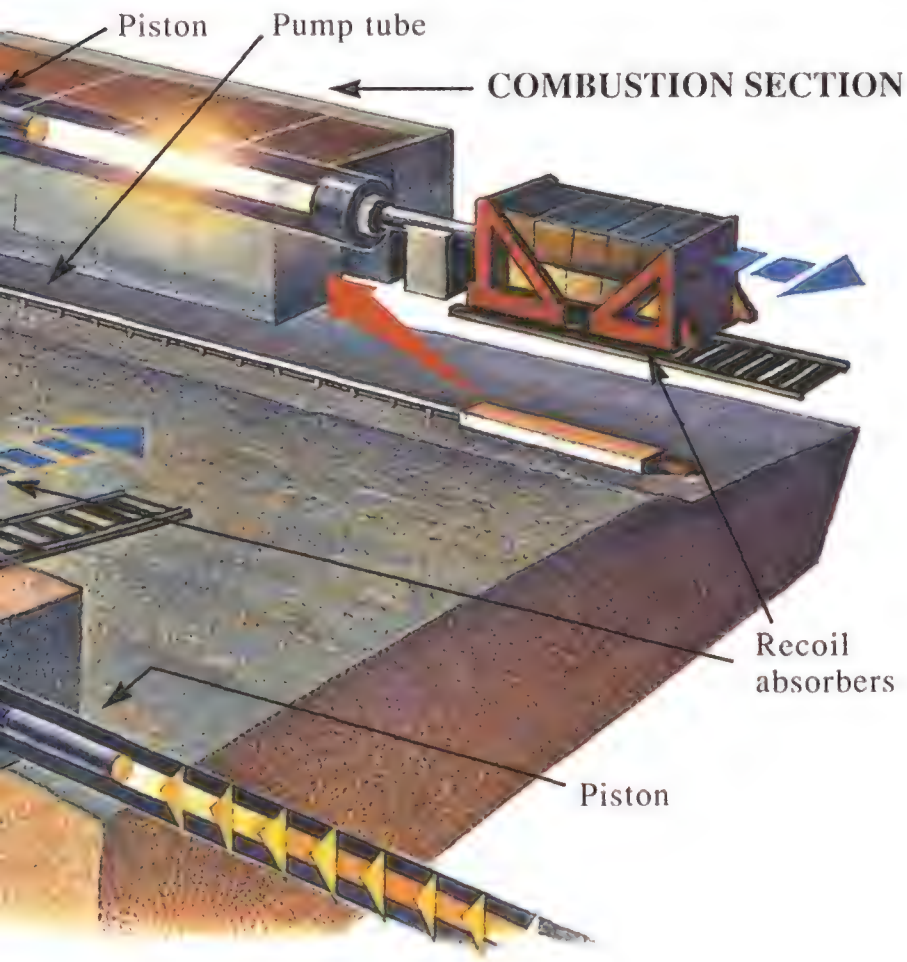
guns, less than 50 feet long, were used for studies that included assaying the impact of meteorites on spacecraft shields. Hunter envisioned a much larger gas gun, so powerful it could substitute for the first two stages of a rocket, literally shooting a spacecraft off the planet.

Assuring himself that it would work took him four months on a computer. "The computer said it worked like gangbusters," says Hunter. "After years of being a theorist, suddenly I was an experimentalist, and it was a huge relief." He produced a 15-foot-long working gas gun, which proved handy at a Livermore funding meeting. "I had colleagues carry the gun in like an anaconda when I made my proposal, and I think that pushed it through the committee, probably because I had it pointed at them."

More-experienced scientists advised Hunter to build a larger-scale, more precise prototype. However, he plunged straight into building the full-size SHARP. "I'd probably have bogged down with the prototype and never built the bigger gun," he observes. Even so, sometimes the project did bog down. For instance, designing the point where the gun's first stage connects at a right angle to the barrel was so tricky that Hunter assigned the job to a supercomputer expert. Six months passed with no progress. Exasperated, Hunter and Fred Reinecker, the gifted engineer who helped him make SHARP a reality, set to work. They began figuring with pencils, on pads. Two days later, they had the answers. "The bottom line," Hunter avers, "is that you still have to be able to think, much as we abhor it."

Assembling the gun for just $2.8 million required deft scrounging. Standing beside the gun today, Hunter and Cartland point out the results. "Those armor plates came from a battleship," explains Cartland. Hunter leans against a massive concrete buttress. "These came from a nuclear testing facility," he says. Noticing that his visitor looks stricken, he adds, brightly, "They're down to background levels of radiation now—I checked them with a Geiger counter." And, he confides, "I just couldn't pass up a free thing!" On the other hand, where it counts,

The burning methane expands, shoving the one-ton piston through hydrogen-filled pump tube. Compressed hydrogen breaks seal in L-shaped high-pressure section, rushes into launch tube, fires projectile from muzzle.



SHARP is a precision instrument. For instance, the gun's 40-ton high-pressure section is machined to precise tolerances; it contains the world's largest forging of the super-tough steel used for the hooks, fitted on Navy jets, that snag arresting wires in carrier landings.

In the beginning, there were bugs. Hunter still winces when he recalls SHARP's debut shot, on December 29, 1992. As everybody waited tensely in the control room, the hydrogen inside the pump tube reached the critical pressure and continued to climb, while the projectile stayed put. The pressure kept building. "I'd erred," admits Hunter. He explains that the coupling holding the projectile in the barrel was supposed to release at a certain pressure. "But I'd miscalculated the release pressure because the coupling has an odd shape. We had to spend ten hours in the bunker, waiting for the pressure to go down." Now the couplings are carefully machined and pretested to make sure they release as planned.

Shot 9 was the most eventful. What Hunter describes as a "tidal wave of black smoke" billowed from the gun, and on the video monitor he could see the armor shielding plates move. The gun had turned into a bomb and partially blown itself up because a sliding vent in the combustion section, where the methane burns, had failed to slide, and pressure built up.

But the bugs are history. And recently, Hunter and Cartland have figured out how to make SHARP immediately useful. SHARP is being used to test a new kind of jet engine, the "scramjet." It is designed to fly at speeds greater than Mach 5; SHARP has already propelled a scramjet to Mach 8, the speed record for this experimental engine. Scramjets may power future hypersonic aircraft, which would fly between 5 and 20 times the speed of sound. Today's best jets cannot handle such high speeds—"The jets peter out at about Mach 5 because they start to melt," says Cartland.

Working with Rockwell International, the Air Force and NASA, Hunter and Cartland have been shooting miniature scramjets out of the big gun at sizzling

Fearless physicist Hunter evicts a gopher snake from a sand mound in the big gun's target-impact tunnel.

speeds. Eighteen inches long and shaped, as Hunter puts it, "like watermelon seeds," the scramjets slam into a sand mound at Mach 8 and disintegrate into molecules. But high-speed cameras and sensors record their flights. The goal is to get a scramjet to accelerate after it leaves the gun's barrel, proving that it can sustain hypersonic speeds. "We're going to do it this year!" predicts Hunter. "We're going to show acceleration at Mach 8, Mach 9, Mach 10!"

It was partly an interest in scramjets that led Cartland to join the big-gun team at Livermore two years ago. Born at Fort Knox in 1958, he comes from a long line of Army officers. After earning a doctorate at the University of California at Berkeley, he became an officer himself. Eventually, however, breaking family tradition, he left the service to pursue his specialties, large-aperture lasers and gas-phase laser spectroscopy. Like Hunter, he was keen on space travel. He, too, had filed an application to become an astronaut; it is still pending. After a stint at Duke University, in 1993 he moved to Livermore. There he heard Hunter's ideas about spacecraft shot from guns. He liked the idea of working on a scientific frontier. "I could be one of thousands of laser researchers, or one of the two guys working on the world's biggest gun," he says. "I rechecked all of John's calculations, and I agreed," he goes on. "With the gun launcher, you could send up cargoes at a twentieth of the cost."

The cornerstone of Hunter and Cartland's cost-cutting breakthrough is their plan to eliminate a conventional spacecraft's cumbersome first two rocket stages, currently necessary to achieve the required velocity of Mach 15. A larger, modified version of SHARP could launch spacecraft at approximately Mach 20 to Mach 23 and replace the rocket's heavy first two stages, dramatically increasing the cargo the spacecraft could carry. Shuttle payloads now cost about $15,000 a pound. Unmanned rockets orbit payloads for about $5,000 to $10,000 a pound. Hunter and Cartland figure their gun launchers could do the job for a mere $250 to $500 a pound. Chicken feed.

Meanwhile, the big gun has acquired a peculiar sideline: helping scientists probe the disappearance of the dinosaurs. Geophysicists theorize that a giant meteor or an asteroid struck prehistoric Earth and disrupted the biosphere, killing off the dinos. The scramjets slamming into a sand mound are good simulations of space objects hitting the ground. "We can deliver higher-impact energies than anyone," Cartland notes. By comparing the scramjet-struck sands with soils from suspected prehistoric impact craters, the dinosaur researchers have been building their case. "After one shot, the geophysicists had a police tape around the impact area to keep people from disturbing the sand," says Cartland. Hung from the tape was a sign: "Police Line—Do Not Cross—Dinosaur Murder Investigation in Progress."

But scramjets and dinosaurs are only peripheral pursuits. "What we want to do," states Hunter, "is build a really big gun." He calls it the Jules Verne Launcher, or JVL. It is named for the French science-fiction writer whose 1865 novel *From the Earth to the Moon* had lunanauts leaving Earth in a spaceship fired from an enormous cannon. In real life, to allow for the slow buildup of velocity that would enable the space travelers to survive their gun launching, the barrel would have to be more than 200 miles long. And so Hunter's JVL would be strictly for nonhuman cargoes, particularly satellites or construction materials for space stations or lunar bases. Even so, the JVL would have to be enormous.

Hunter and Cartland foresee the JVL shooting spacecraft into the sky once or twice a day, delivering thousands of tons of cargo into orbit every year. To ensure sufficiently gradual acceleration inside the gun to protect a spacecraft's fragile components, the JVL's barrel would have to be nearly four feet in diameter and more than two miles long, running up a mountain. Simply scaling up the SHARP gun would not work. "For instance, we'd need a 10,000-ton piston to compress the hydrogen, and that would mean we'd need a million-ton reaction mass to absorb the recoil," explains Hunter.

So the JVL would have no piston. It would compress the 40 tons of hydrogen needed for each launch by heat-

ing it in enclosed chambers. Then the compressed hydrogen would whoosh into the gun barrel through a succession of openings. The projectile would receive a burst of hydrogen to get it going, another to speed it up, another to accelerate it further, each burst timed to accelerate the projectile smoothly. A device at the gun's muzzle would recapture most of the hydrogen to reuse for the next shot, saving—Hunter whips out a calculator and punches keys—about $200,000 per launch.

Hunter and Cartland already have plans to build a smaller JVL-type gun for launching communications satellites, which can take harder accelerations. The small JVL would shoot a satellite to an altitude of 310 miles at about 20,000 feet per second. Then a small rocket would nudge the satellite into orbit.

An ordinary rifle shoots a bullet at 2,000 feet per second. The current SHARP gun shoots projectiles at 10,000 feet per second. The Jules Verne Launcher would propel projectiles at 23,000 feet per second. It would cost about $1.5 billion to build, but Hunter and Cartland figure it would quickly earn back its construction costs.

Hunter, meanwhile, following one of his impulses, recently moved his family to San Diego to set up a company to develop an ultrasound cancer treatment. He also is designing a new football. He says even an ordinary person will be able to throw it 200 yards. "It's for old people like me, who want to throw a long pass but can't, because of arthritis," he banters. But he remains a Livermore consultant, still working on the big gun. And his thoughts are still on space. "Our way, you could send a whole town to Mars," he quips dreamily.

Hunter and Cartland have checked and rechecked their computations for the JVL. But, if pressed, they will admit one glaring omission. It concerns *From the Earth to the Moon*, Jules Verne's inspirational novel. "Actually," says Hunter, sheepishly, "I'm just getting around to reading it." Cartland looks sheepish, too. But then he brightens. "I saw the movie," he says.

A test shot captures an explosive moment: residual hydrogen bursts into flame (far left) when it escapes from high-pressure section of supergun. Simultaneously, projectile blasts from muzzle (far right) in fiery blaze.

They're holding on: ordinary people, extraordinary lives

Long ago, they found a talent or a cause, a way of life or a way of work, then stuck with it—and said to hell with what other people think

"Eccentrics, visionaries, dreamers, believers: men and women in pursuit of *something*, and holding on to that at all costs"—these, writes David Isay, are the people he and Harvey Wang are drawn to. For three years Isay, who produces pieces for National Public Radio, and photographer Wang traveled the country, turning the spotlight on such homegrown originals as hobo elder statesman "Steam Train" Maury Graham, and Virginia Belle Brewer, curator of Brewer's Bell Museum in Canton, Texas; Jim Searles, president of the Brooklyn Elite Checker Club, and Lydia Emery, an Oregon doctor who hasn't raised her fees since the 1940s; Charlie DeLeo, "keeper of the flame" in the Statue of Liberty's torch, and dozens more. First aired by NPR as part of the American Folklife Radio Project, Isay's Peabody Award-winning interviews are now excerpted in a new book, *Holding On*, published by W. W. Norton. Together with Harvey Wang's penetrating photographs, recently exhibited at the Smithsonian's National Museum of American History, they capture the dignity and passion, pain and even obsession of these proud survivors. (A *Holding On* CD released by Shanachie Entertainment, hosted by NPR correspondent Susan Stamberg, features ten of the interviews broadcast between 1990 and 1994.) In an insightful preface to the book, Henry Roth, whose 1934 classic novel, *Call It Sleep*, preceded his second novel by almost 60 years and who knows about surviving, writes that the subjects of *Holding On* are "people who still exercise their creativity, their artistic or collector's or storytelling skills, and don't shirk what they are still capable of doing. . . ." Or, as Isay and Wang concluded, "there was a single, simple criterion we'd been using all along for inclusion in this book: these were all people we'd fallen in love with."

Suzanne Crawford

"It's kind of hard to find, but you'd be surprised how they do get here," said Dixie Evans, curator of Exotic World. Since 1990 the former "Marilyn Monroe of Burlesque" has cared for the tassels, g-strings and other relics of the "burlesque historical society," located "half-way between Las Vegas and L.A." Burlesque, Evans informed Isay, began "in England in the sixteenth century. . . . It was just music hall," but when "Lydia Thompson and her British Blondes" came to America in 1861, a mishap onstage led to the first striptease. Explaining her own start as a stripper at age 18, Evans was frank: "A couple of times I worked in a burlesque theater as a page—and I said 'Wow! She's getting two hundred and fifty dollars a week, and she's about forty-five'—you know how you think when you're real young—'and here I am getting sixty-five dollars. There's something wrong here!'"

"Been bit one hundred and sixteen times—you'll keep count of that!" boasted Dewey Chafin of Jolo, West Virginia. "See that finger? It came off with a copperhead bite." Chafin, a serpent handler for 38 years, believes literally in Mark 16:18: "They shall take up serpents; and if they drink any deadly thing, it shall not hurt them; . . ." (members of Chafin's church also drink strychnine). There have been only 70 confirmed deaths from serpent handling since the practice was begun by George Hensley in 1909. Believers in a trance state may not show the fear that can prompt a strike and, when bitten, process the venom better than others. The Church of the Lord Jesus was founded by Chafin (left) with his mother, Barbara Elkins (right)—who was a convert of Hensley's—and her husband, Pastor Robert Elkins. At services, members dancing and speaking in tongues take the serpents from their boxes as the spirit moves them. On a Sunday in 1962, Chafin's sister, Columbia, was bitten. "It bit her while she was getting it out of the box and it hung onto her," Chafin said. "She lived till Thursday. . . . We went back to church the next weekend, handling serpents the same way. That's what she would have wanted."

"I started out as a hermit, but I'm in the tourist business now." "Dugout" Dick Zimmerman, owner of the ten-cave Dugout Ranch near Salmon, Idaho, is a prospector, but when a mine is exhausted he seals the walls with mud and stone, and pops in a scrap-wood door and a car-windshield window from the junkyard. The rooms, with a box-spring and mattress, a woodstove made from a trashcan and a view of the Salmon River, are "surprisingly pleasant," Isay found. Some have a school-bus seat for a couch and an icebox for a closet. "I only charge two dollars a night for a room," Zimmerman said. "No swimming pool, but we got a hot springs over that hill. No TV, but I play the guitar, and the people seem to like it. . . . I've been here since '48. Wouldn't want to live nowhere else but a cave!"

"Two hundred and fifty thousand guests in forty years!" exclaimed New York City talk-show host Joe Franklin. When Isay interviewed him in 1990, Franklin, who claims to have invented the talk show, fielded phone calls from talk-show wannabes with his usual hyperbole: "*Dan! How are you my boy? Dan, I need you maniacally! Pathologically! Desperately! . . . Keep me notified! [Slam]*" "I read in magazines about people who never did talk shows: Cary Grant . . . James Cagney . . . John Wayne, John Lennon, Elvis Presley. I've got the photographs and old kinescopes to show that these people were on *my* show. . . . And I try to give the little guy a shot. . . . I've had dancing dentists. Singing lawyers . . . cab drivers who do handwriting analysis—you name it, I've had it." *The Joe Franklin Show* went off the air in 1993, but in 1994 Franklin assured Isay, "I've got fifteen actually *pleading* offers . . . to return to five-day-a-week TV!"

"We were the first!" revealed Geneva Tisdale of the day in 1960 when the lunch counter at the Greensboro, North Carolina, Woolworth's began service to blacks. She was a cook at the counter, now in the Smithsonian, when sit-ins by black students closed the store, which agreed to desegregate. The counter manager declared, "'I want three of my girls to be served first when it reopens.' And I was one," Tisdale said. Arriving in uniform, the women changed into street clothes and sat at the counter. "I ordered a egg salad sandwich, and I swallowed it!" laughed Tisdale. They got back into uniform, and "the photographers and people started crowding in—and they didn't know it was us!" Tisdale worked there 42 years, planning to dine at the counter again one day. It closed suddenly, and she never did.

"There was dust everywhere and an old calico curtain hanging up on the stage. . . . There was a magic to it, and I thought to myself: 'This theater has got to be mine!'" A flat tire brought Marta Becket to Death Valley Junction, California (pop. 7), in 1967, but the theater has kept her there. Becket's classical dance career was faltering amid the rock revolution of the '60s, when she noticed the rundown theater while having her tire repaired. She and her husband leased it for $45 a month, renamed it the Amargosa Opera House and began fixing it up. Her first show drew 12 customers; sometimes, that year, nobody came. So Becket painted an audience on the walls and kept on performing. In 1983 she took Tom Willett as a partner (and let her husband go). "She has made a comic actor out of me!" Willett told Isay. And now, from October to April, the Amargosa is one of the hottest spots in the Mojave Desert.

By Cheryl Lyn Dybas

The deep-sea floor rivals rain forests in diversity of life

Blue luminescence and marine snow define a world where millions of species of worms and other invertebrates live out their lives

Two sea anemones (actually animals) use a glass-sponge stalk to catch food particles above the ocean floor. *Johnson-Sea-Link I* (opposite) returns from the depths.

A few miles off the coast of Negril, Jamaica, crewman Charlie Ridler closes the vaultlike hatch of the *Johnson-Sea-Link I* (*JSL*), a 23-foot research submersible. Charlie and I share the rear passenger chamber. In the bubble up front are biologist Shirley Pomponi and pilot Kenny O'Brien. We are going to dive a thousand feet or more beneath the water's surface, beyond the world of sunlight and plants, to the realm of darkness.

There's little time to get comfortable in the closet-size space, only 3 feet by 6 feet. "You can sit with your legs curled beneath you, kneel with your face pressed to the porthole or lie with your feet raised," advises Charlie. He goes on to explain the emergency procedures for raising the sub to the surface if both pilots should become disabled. However, as we sway like a Ferris-wheel chair on a cable several feet above the ship's stern, to quickly memorize a five-valve sequence and which way to turn each valve is difficult.

Charlie's voice is soon drowned out by the sounds of O'Brien's communications with operators on deck, the whir of scrubbers that remove carbon dioxide from the air inside the sphere and the occasional *pong* of a transponder that will communicate the sub's underwater location to the *Seward Johnson*, its mother ship. As the *JSL* is lowered to the ocean surface, the view changes from its steel support to a condominium complex on shore, to the light blue-green of the sea. "Touchdown," says Charlie, as waves splash at the portholes, and the craft gently sloshes back and forth in the Caribbean. "Make yourself comfortable—or as comfortable as you can," he continues, "we're going to be here together for three hours or so."

Suddenly I find myself thinking of Alice in Wonderland: "Down, down, down. Would the fall never come to an end!" On our dive we might not see creatures as bizarre as those in the works of Lewis Carroll, but we would see surprisingly successful adaptations to what for us would be unimaginably harsh conditions. In a world of eternal darkness, we would get an inkling of what it is like at the bottom of the sea, the abyssal plain that lies seaward of continental shelves and slopes. Not only do creatures of the dark exist, but they are present in such numbers and in such diversity of species that veteran marine biologists have been awed. Rather than being a lifeless expanse, the bottom of the sea throbs with life. Granted, most of it consists of worms, bivalves, mollusks, crustaceans and other tiny invertebrates that live beneath the surface of the sediment. But some larger organisms are easily visible to cameras lowered from

Rattail swims along bottom 13,000 feet down in eastern North Pacific.

the surface, not to mention lucky observers in submersibles.

Often seen are the many kinds of rattails, or grenadier fish, related to the cod family (above). Large-eyed, opportunistic feeders that grow to a length of more than three feet, they are found at depths as great as 20,000 feet.

Present in every shape and size, not to mention occasionally in herds, are the holothurians, the sea cucumbers (below). Their name describes the shape of many; these are soft-bodied animals that move along the bottom, some using their tentacles to stuff sediment into their mouths.

Glass sponges are nearly as ubiquitous. Even better described by their common name, these just-barely-animals strain their food from the water. Their glasslike stalks are home to sea stars, sea anemones and other invertebrates both while alive and after death, when only their stalks remain.

Sea urchins (p. 101) cut a swath through the mud as they pick out dainty morsels. Some polychaete worms form tubes above the mud that look like nothing so much as croquet wickets.

Life in the ocean depths is no doubt unfamiliar, even to most biologists. Oceanographers are finding that biodiversity there apparently rivals that of such species-rich environments as tropical rain forests and coral reefs. It now appears that there may be ten million or more species down there.

Virginia-based writer Cheryl Lyn Dybas is working on a book about ongoing discoveries in the abyss.

Until the mid-19th century, most scientists had assumed there was little or no life at the bottom of the sea. They knew it was almost totally dark and very cold, and that the pressures were enormous, measured in tons per square inch. The darkness alone meant there could be no plant-based food webs, no beginnings of food chains such as those that exist on land and in the shallower parts of the sea. One 19th-century biologist, in fact, asserted that no life could exist below about 1,900 feet.

Now we know that the deep-sea bottom and the water directly above it are alive with creatures that slink, crawl and swim through the perpetual night. Only in 1967, when marine biologists reported the results from a new collecting device, did opinions change. When the epibenthic sled, as it is known, was tried in deep water, the numbers of species found were much greater than the numbers for equivalent samples taken in shallow waters, whether temperate or tropical. A single sample often contained many times the number of animals previously caught during entire expeditions.

The key to the ecological web of life in the deep turned out to be "marine snow": the never-ending precipitation of bits of plants and animals falling from above. This detritus sinks at a rate of from hundreds to thousands of feet per day. These fragments of the departed, waste materials and other organic debris are the beginning of the deep-sea benthic food chain, just as plants are on land and in the surface water of the sea.

Now, of course, we know that brightly colored six-foot worms and dense concentrations of clams and shrimp live around hydrothermal vents, where, some scientists speculate, life may have first arisen. Sulfur-eating bacteria thrive on the noxious compounds rocketing out of these underwater hot springs, and they in turn, support "islands" teeming with life.

On land we walk around at the bottom of an ocean of air. At sea level, it presses on us, 14.7 pounds on each square inch. We don't feel it because we breathe in air at the same pressure. Water, of course, is much heavier than air: as you descend into the sea, the pressure increases by one atmosphere, or that same 14.7 pounds per square inch, for every 33 feet you go down. Once away from shore and the continental shelves, the average depth of the deep sea, the true abyss, is 12,000 feet. At that depth, the pressure on each square inch of any object is on the order of a crushing 2.5 tons, or about 360 atmospheres.

Thanks to new technology, scientists are seeing seafloor life-forms—if only for the briefest of periods—through the portholes of submersibles or with television cameras mounted on remotely operated undersea vehicles. Strange fishes prowl the gloom. Some create their own light to lure prey or to escape becoming a meal themselves. Eerie sponges as large as Grecian urns filter food from the frigid waters, while the arms of living fossils called crinoids reach out to snare the remains of other animals slowly drifting by in the darkness.

There are gelatinous deep-sea jellyfish and octopuses, as well as such bizarre species as the tripod fish, which rests on the bottom on enormously elongated pectoral and anal fins. There are also spotted ratfish, or chimaeras, with their elongated snouts and dirigible bellies, not to mention congrid eels. Everywhere in the sediment there are tracks, some of crea-

Sea cucumber's large tail may enable it to "sail" with the gentle currents.

Accord EX V-6 model featured. ©1995 American Honda Motor Co., Inc.

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tures we know about and some of creatures we have yet to see.

In spite of recent advances, says the Smithsonian's David Pawson, the state of our knowledge about what's down there is about what we would know of terrestrial creatures if we studied them by dropping grappling hooks from hot air balloons at night, bringing up only policemen and postmen. Researchers estimate that less than 1 percent of the deep sea has been explored.

Ventilators kick in, and suddenly the air feels cool and fresh. Charlie checks the hatch on the floor for leaks and then announces, "We have a seal." The mother ship replies, "You have permission to dive." With a clunk, the crane releases the *JSL* from its tether. As the craft begins to sink, a cloud of bubbles, sparkling like scattered diamonds, ever so slowly floats to the surface. At last, the *JSL* is on its way to the deep. "We have no idea what we'll find," comes Shirley's voice over the headset. "But we chose this site because a depth profile of the area indicated a relatively steep slope, which we hope will be colonized by many deepwater animals."

The *JSL* is now dropping at the rate of 100 feet per minute into a darkening ocean. A giant barrel sponge looms into view. Like enormous vats covered with deep vertical ridges, these sponges can reach six feet in height. Further along the slope, a garden emerges: speckled and giant tube sponges, orange and white rope sponges, sea whips and black corals

On another sponge stalk, anemones present front (right) and rear views.

Invertebrate freeloaders crowd the stem of trumpet-shaped glass sponge.

cling to every rocky promontory I see.

Shirley's voice interrupts my reverie. "Look outside—what we're doing here resembles space exploration in so many ways, including the view of thousands of 'stars.'" The points of light are actually bioluminescence, parts of otherwise unseen creatures that glow. Kenny turns on the outside lights, and now we see—in a blizzard of marine snow—shrimp, comb jellies and clouds of plankton. A muffled thump, and the sub settles on the bottom, looking like a goldfish bowl with humans on display. "We're at 1,100 feet," announces Kenny. "Shall we 'fly along' and see what we find?"

Scientists refer to creatures living at and below the continental slope as deep-sea life-forms. How do these animals survive? Harbor Branch Oceanographic Institution scientists such as Shirley Pomponi, physiologist Tom Bailey and algae expert Dennis Hanisak—as well as a number of Smithsonian scientists who use the *JSL*—are beginning to uncover the answers.

The scientific community began to suspect biological riches on the ocean floor in the 1860s, when dredges lowered to a depth of 2.6 miles brought up a claylike ooze made up almost entirely of tiny organisms. The most productive cruise in history, that of HMS *Challenger* in 1872-76, laid the foundation for our current knowledge of life in the abyss. Animal life was discovered as far down as 3.4 miles.

Through the *JSL* portholes we see a white trumpet shape that turns out to

Foraging sea urchin (bottom) leaves a trail like that of a highway grader.

be a glass sponge (opposite). It looks as delicate as an open orchid flower or a crystal goblet. Deep-sea sponges have skeletons made of silica, their complex, interlaced needles like fine hairs of spun glass. This intricate network of lacy glass spicules can resemble anything from a bird's nest, to braided ropes, to the tangled mane of Cousin Itt in *The Addams Family*.

"Let's pick up this one," comes Shirley's voice over the headset, followed by the whine of a suction sampling device called a "critter-gitter," operated by Kenny. Each collecting site is documented with still and video cameras. A recorder tapes Shirley's notes. Instruments on the *JSL* are recording the time, and the depth, temperature and salinity of the water. Shirley is investigating whether deep-sea sponges possess unique compounds with potential biomedical applications (she wrote about sponges in the December 1978 SMITHSONIAN). The sponge retrieved, the *JSL* hovers for a brief moment, then moves on.

At 1,040 feet, our lights illuminate a ghostly-white sponge, a phantasm come to life in the shape of a cup. Sponges that live in the deep sea, some to depths of 3.5 miles, are more likely to be white or gray than the yellow or orange of their shallow-water relatives. The pigments of some shallow-water sponges are thought to act as "sunscreens," which the animals don't need in the darkness of the deep.

In the early decades of this century, scientists on pioneering expeditions brought up their finds in nets and dredges, never able to visit or even view the environment they studied. Then, in 1934, biologist William Beebe and engineer Otis Barton were lowered to 3,028 feet in a steel ball they called a bathysphere. "Here I was privileged to peer out and actually see the creatures which had evolved in the blackness of a blue midnight, which, since the ocean was born, had known no following day," wrote Beebe in *Half Mile Down* about the organisms he saw during the descent.

In the 1950s ways of descending to deeper and deeper waters were developed. In 1960 Jacques Piccard, a Swiss engineer, and Lt. Donald Walsh, a submarine officer in the U.S. Navy, took the deep-diving bathyscaphe *Trieste* to 37,800 feet in a black chasm seven times deeper than the Grand Canyon. Today we have manned submersibles like the *JSL*, and unmanned, remotely operated vehicles (ROVs) that are tethered robots lowered from oceanographic research ships.

Pressure, temperatures just above freezing, a scarcity of food and a lack of light all play a part in the eerily beautiful and often bizarre forms deep-sea animals have developed. "The fantastic shapes and colors and details of anatomy of the denizens of the deep sea are part of evolution's ef-

Shrimp also inhabit the depths; many display bioluminescent patterns.

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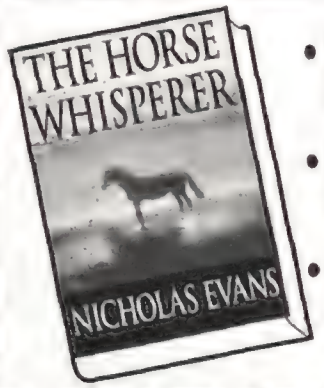

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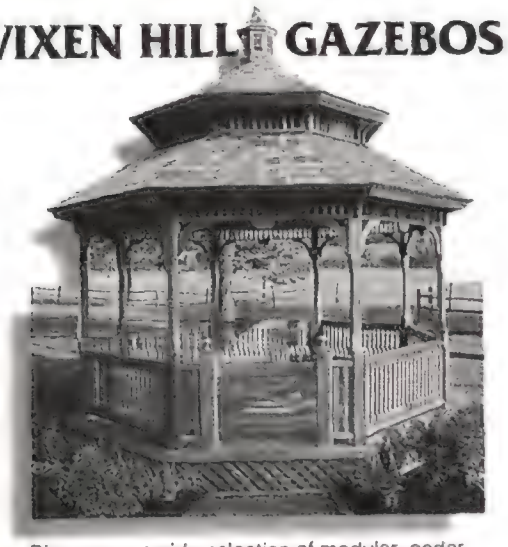
Two octopuses are all tangled up 8,200 feet down in the Pacific. Unless the smaller one gets away, biologists would expect it to be eaten by the larger.

VIXEN HILL GAZEBOS



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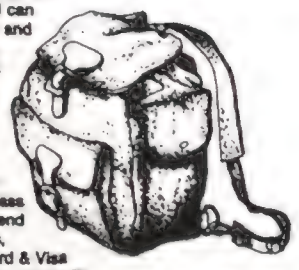

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fort to get them in tune with their incredibly harsh environment," wrote C. P. Idyll in his classic work on deep-sea life, *Abyss*. For example, to withstand the pressure of the depths, some deep-sea fish have flesh more like that of jellyfish. In fact, one fish that lives in the abyss has a cocoon of gelatin surrounding its entire body, covering even its fins and eyes.

In the ocean depths, currents are weak and water movements sluggish, so here evolution has reduced the skeletal structures and muscles of animals also found in shallower water. Deep-sea sponges, for instance, don't need to withstand pounding by waves or tossing in currents and thus can survive with more delicate bodies.

Quantities of gelatinous material and a lack of heavier muscle in deep-sea animals, particularly those found floating just above the seafloor, serve to make them more buoyant. Energy is conserved that would otherwise be used to keep from sinking. A price has to be paid, however: the animals' movements are much slower than those of their counterparts near the surface. These slower motions may also be related to food scarcity and cold temperatures. Biologists believe that animals here have metabolic rates ten times lower than those of upper-ocean organisms. Food is scarce for larger, more mobile predators like deep-sea fish; therefore, the numbers of these larger animals are low. They have to eat one another or move thousands of feet upward to find smaller fish to prey upon. Because marine snow is the most abundant food source in the deep, deposit and suspension feeders, such as worms and sponges, are the most common animals here. But larger "food-falls," like whale carcasses, attract larger animals.

Among the most numerous inhabitants of the depths are sea cucumbers, which have been caught as deep as 36,000 feet. Many abyssal sea cucumbers, like the ram's-head-shaped *Scotoplanes*, live atop the mud. They look like squishy wursts; their appearance fairly shouts "bottom dweller." But marine biologists have recently discovered a group of abyssal species that, contrary to all we know, swim. As zoologist David Pawson has observed, "Indeed, one can hardly invoke a less ap-

propriate term than 'sea cucumber' to describe these translucent, jellyfish-like, undulating animals."

Another of the graceful creatures of the abyss is a deep-sea octopus, *Cirrothauma*, which is so fragile and gelatinous that it was initially mistaken for a jellyfish. Called a cirrate octopod, it is named for the cirri, or fingerlike projections, that line its webbed arms. According to the Smithsonian's Clyde Roper, these cirri might sense food in a dark world.

Many deep-sea creatures are red, scientists believe, because no red wavelengths penetrate to these depths. A red animal, therefore, cannot reflect light and thus blends into the blackness, eluding predators. Although the abyss is almost totally dark, a small amount of soft, pale blue light is produced by bioluminescent organisms, enough to illuminate prey to predator.

We already know some of the exotic red denizens of the deep. One of them is the crustacean *Gigantocypris*—actually about the size and shape of a cherry—which drifts through the water sporting a bold orange-red. Or to be more accurate, it is red when seen on the surface. In its natural habitat hundreds to thousands of feet down, this fragile creature fades into black.

Jules Verne wrote in *Twenty Thousand Leagues Under the Sea* of a deep-sea "Coral Kingdom" seen by the crew of the submarine *Nautilus*. No less magical is the world just under the *JSL*'s

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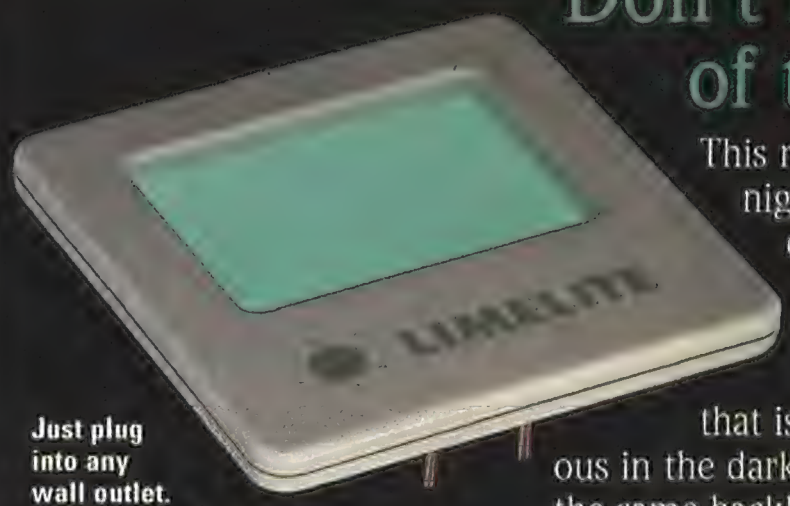

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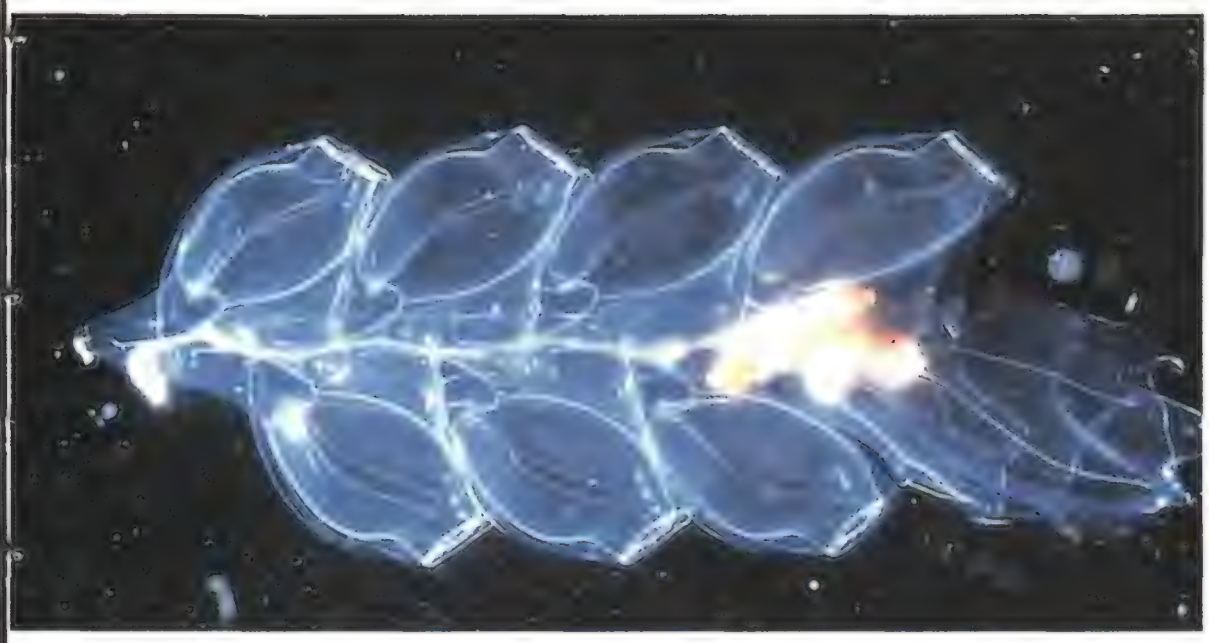
whirring thrusters. "This place must have 30 to 40 species of deep-sea sponges alone," says Shirley.

Hidden among the sponges and sea lilies are featherstars, which look like a cross between a chrysanthemum and a giant hairy spider. These relatives of the stalked sea lilies, such as the candy cane featherstar, the lovely slender featherstar and the giant yellow featherstar, also feed on drifting detritus. Somewhere beyond the sea whips and the *JSL*'s lights are deep-sea starfish that, far different from their slow-moving counterparts in the shallows, "run" along the bottom at speeds of up to two feet per minute.

How do animals find food—and mates—in this dark realm? "As if reluctant to settle for inky blackness, they have made a brave attempt to light their forbidding environment," wrote Idyll. "They carry their own lights on their heads and on every other conceivable part of their bodies, including their eyes and tails and the insides of their mouths! The light they shed is living light."

Biologists believe that most deep-sea animals are bioluminescent. These creatures use light to lure prey into a trap (the lighted maw of the black anglerfish, for example), to illuminate their surroundings (the sheet of light cast outward by lanternfish) and as signals to attract mates (the greenish-yellow flashing lights of deep-sea shrimp). The entire body of one swimming sea cucumber lights up when it touches a potential predator.

Gulpers are found down to 4,000 feet and can ingest prey as large as they are.



This siphonophore, about four inches long, is actually a colony of animals that live together permanently. Some species grow to be 60 feet long.

On some submersible dives, pilots flash the vessel's lights rapidly on and off, eliciting answering flashes from one or more of the twinkling creatures of the abyss. "But whether they think we're a potential predator or mate is hard to tell," says one scientist.

All too soon our dive comes to an end. "Request permission to leave the bottom," Kenny says. The mother ship grants permission, Kenny shoots air into the ballast tanks, and we ascend to the world of sunlight.

A few months later I had the opportunity to see creatures of the deep through the medium of a different technology: a television screen on which was displayed the view of a camera mounted on a remotely operated submersible. I was at the Monterey Bay Aquarium Research Institute (MBARI) in Moss Landing, California. Bruce Robison and his colleagues there use the *Ventana*, a small vehicle that is tethered to and operated from its mother ship, the *Point Lobos*.

Once again I find myself going to sea. At 7 on a July morning, the *Point Lobos* prepares to leave its dock in fog-shrouded Moss Landing, headed for the open waters of Monterey Bay. The aroma of coffee mingles with the smell of diesel fuel and the sharp scent of salt air. At nearby docks, fishing crews are busy readying other vessels in the harbor; they will ply the bay's waters with little inkling of the creatures lurking deep beneath their nets.

Within a couple of hours, the *Point Lobos* reaches its destination above the Monterey Submarine Canyon. Although the *Ventana* is a high-tech research tool, somehow its size and shape bring to mind a children's film version of a Volkswagen bus—with headlights, "critter-gitter" cylinders, a manipulator arm and four video cameras. A crane lifts the vehicle over the vessel's side, and fiber-optic cable begins to play out.

Scientists make their way forward to the darkened control room, where screens display whatever *Ventana*'s cameras see. As the vehicle descends, a squall of marine snow fills the video screens. At a little more than 850 feet, one of the creatures the scientists had been awaiting appears: the gently turning, shimmering form of *Kiyohimea*, named for a mythological Japanese princess. This comb jelly, so called for the rows of sparkling comb plates that line its translucent-pink body, is searching for food.

Kiyohimea loses its beauty out of water. "Before the advent of manned and unmanned submersibles," says Robison, "we brought up these fragile animals in nets. By the time we got them to the surface, they were so torn apart that we couldn't even piece together what they had looked like."

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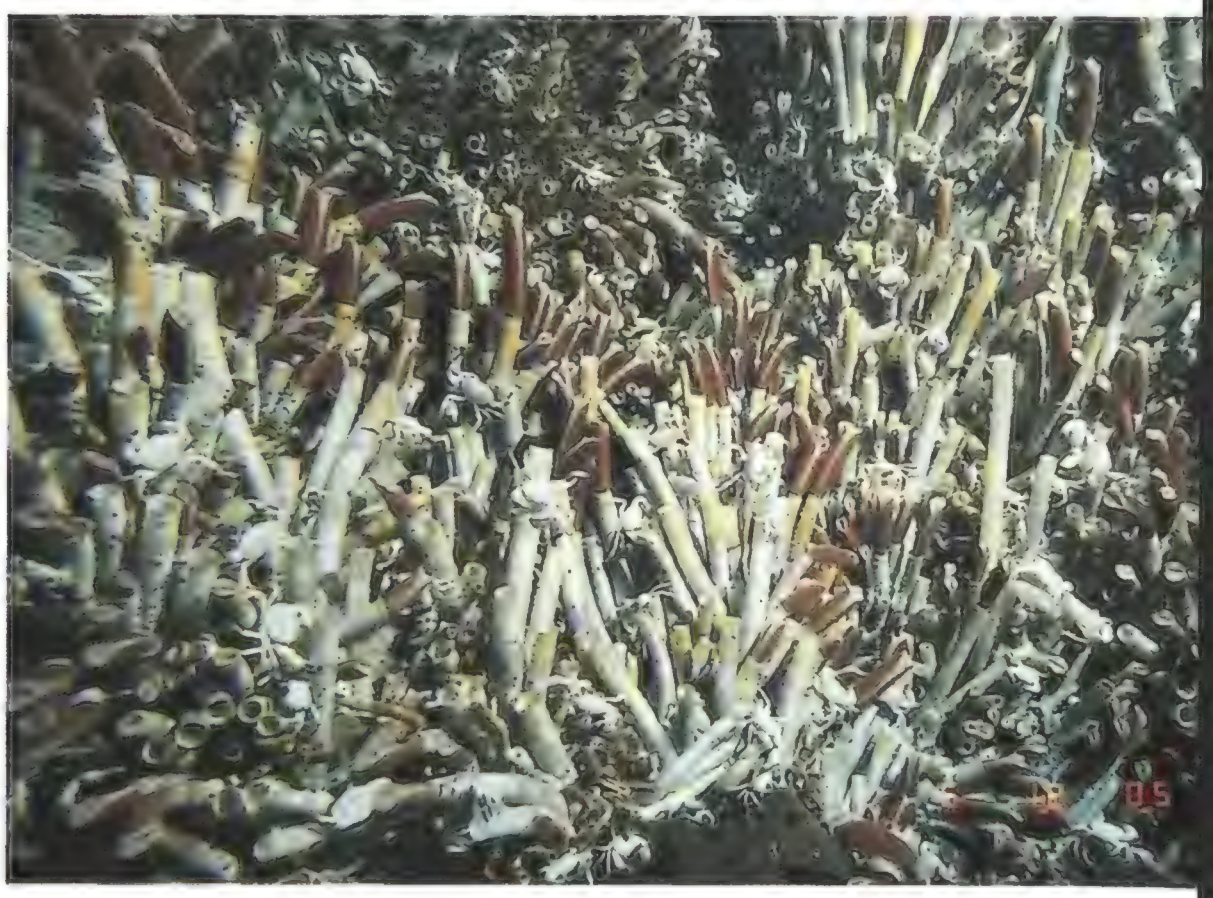
Nearby drifts another delicate creature, a free-swimming, pelagic tunicate. To trap marine snow, the tunicate spins a butterfly-shaped, gossamer web of mucus around its three-inch-long body. This web can reach several feet in width. When its dwelling becomes clogged with debris, the animal simply sheds it and builds a new one. The cast-off house becomes marine snow.

One of MBARI's most recent finds is another comb jelly, named *Lampoctena sanguineventer*, or "brilliantly shining, blood-red-bellied one." The ruby, golden-comb-lined creature appears below 1,300 feet. "We've completely underestimated the variety and abundance of gelatinous animals in the deep sea," says Kim Reisenbichler, Robison's research technician. Other jellylike voyagers of inner space found in the depths of Monterey Bay include a string-of-pearls-shaped colony of animals lined with stinging cells, called a siphonophore (p. 105), that may reach a length of 60 feet, and a deep-sea squid that, with its spindly shape, avoids predators by mimicking this siphonophore's elongated silhouette.

By the year 2000, the Monterey Bay Aquarium (SMITHSONIAN, June 1985) will have opened a new exhibit on the ocean's depths, showcasing creatures of the deep, many brought to the surface by the *Ventana*. A few are already awaiting their "day in the sun," like the sea cucumber *Pannychia*, which glows with green light. Says Chris Harrold, director of life sciences at the aquarium, "We'd like this exhibit to show people the variety of life in the deep sea and leave them with an appreciation of the environment these amazing animals continue to evolve in."

"Today we know that the abyss is haunted," wrote Loren Eiseley in *The Immense Journey*, but "there is no need to be frightened. It is true some of the creatures are odd, but. . . . It gives one a feeling of confidence to see nature still busy with experiments . . . things brewing and growing in the oceanic vat." In the netherworld, there are creatures as fearsome as the giant squid of Peter Benchley's novel *Beast*, and as beautiful as the deepwater dwellers in the film *The Abyss*. Fact is indeed stranger than fiction, for here in the darkness, beneath tons of icy water, life thrives in exquisite abundance.

Six-foot tubeworms crowd around a seafloor hot spring. The ecosystem depends on bacteria that metabolize sulfur in the mineral-laden water.



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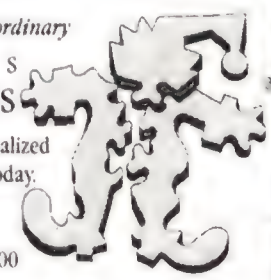

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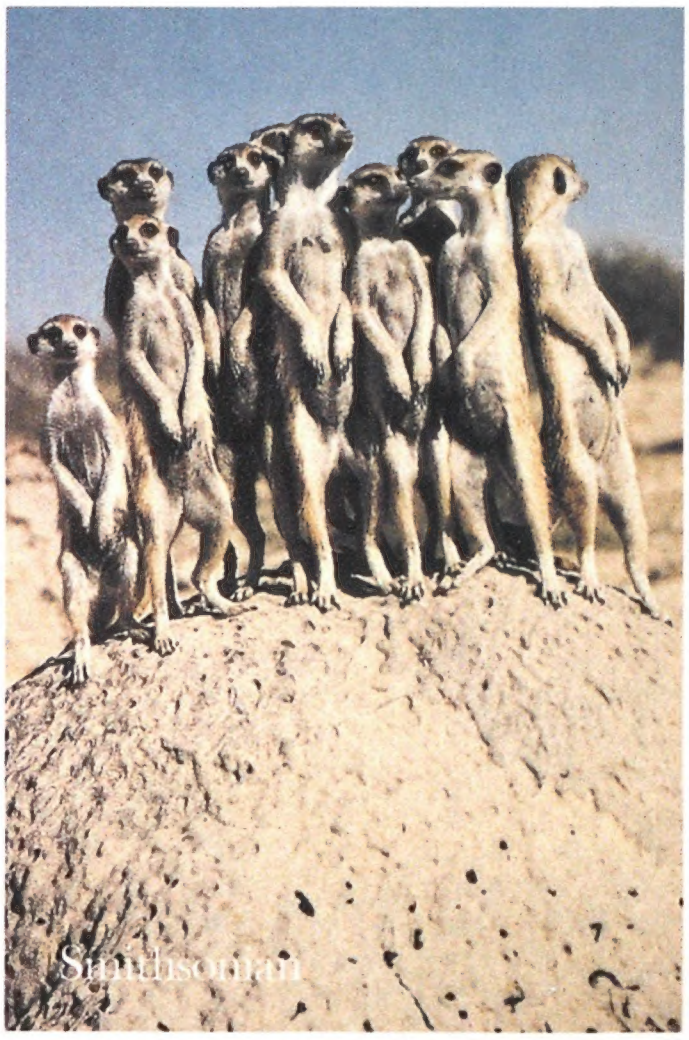

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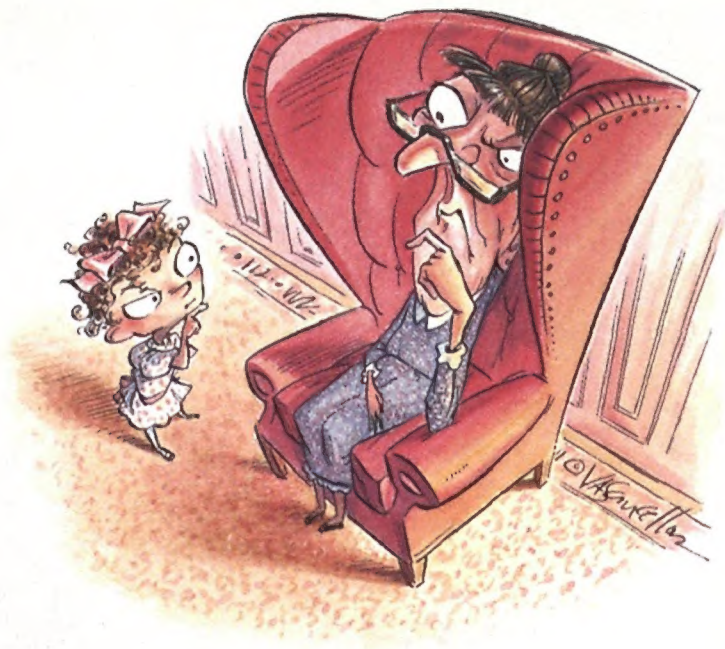


It's not polite to ask questions, but who says you can't think them?

My parents were invited to the Cunninghams' once a year. When I was 9 they dared bring me along. "Don't ask too many questions," my mother instructed.

"How many is too many?"

"One."

None! No questions at all; my parents would insist on Good Behavior. Their own behavior would be Extremely Good. They would not be recognizable as the couple who brushed their teeth side by side, amiably spitting across each other's arc.

Dr. and Mrs. Cunningham lived in a brownstone in the oldest part of our New England city. On the ground floor were two professional offices—Dr. Cunningham's and my father's. The men were ophthalmologists. I was the only person in my class who could spell that word, though every one of my irritated classmates now knew what it meant.

The Cunninghams received us in a red parlor. A fire burned in the hearth, underneath the portrait of an Ancestor. The Ancestor wore a white scarf instead of a tie. He had a mouth with no lips.

Mrs. Cunningham sat on a wing chair to the left of the fireplace. Dr. Cunningham came forward to shake hands with my mother, whom he had last seen 52 weeks earlier, and with my father, whom he had last seen yesterday. He shook hands with me, too. His hand was dry and warm.

Mrs. Cunningham merely gazed at me long and hard. I returned the inspection, taking in the pewter bangs, the brown eyes behind glasses, and the dress with its print of tiny flowers. She blinked first (I was class champion at holding stares). "My daughter had curls like yours when she was small," she said.

Does she shave her head now that she's big? Was she an only child? How many questions was she allowed? "Curly hair sometimes gets straight later," I explained to my hostess.

"We have two sons and a daughter, all with straight hair," offered Dr. Cunningham. "They live in other places."

In Fall River? In Kathmandu? Do they look like the Ancestor? What are their names? "My favorite name happens to be Frederique."

My father cleared his throat.

"Our children are called Hartley and Fuller and Hale," said Dr. Cunningham. "Hale is the girl."

Hartley and Fuller were avenues in our city. Hale Park was home to the arboretum and the zoo. *Had the Cunningham children been named from a street map? Had Mrs. Cunningham's dress come out of her own attic, or somebody else's?*

"Perhaps it seems odd to you that we don't live on our first floor," said Mrs. Cunningham.

"Oh, no. Uncle Barney and Aunt Celia live over the hardware shop. They sleep in the dining room so that the kids—four boys and a girl—can have the bedrooms. Their bed is right where the dining table should be." *Where is your bed? Where is your dining room?*

"I'm sure you'd like to explore," Dr. Cunningham said. "There are lots of books in the study down the hall. I can tell that you're a reader."

I was indeed a reader; but as soon as I slipped into the study I ignored the books in favor of the three framed photographs on the desk. The Cunningham children! Hale's wedding gown had a high neckline. She wore a Good Behavior smile. Hartley—or perhaps Fuller—looked solemn, and so did his horse. Only Fuller—or perhaps Hartley—seemed cheerful. He stood on a lakefront dock, barefoot, his tuxedo jacket open, his black tie half off. His grin invited me to join him on the wet boards. I put him down, and with my sleeve wiped the glass free of fingerprints.

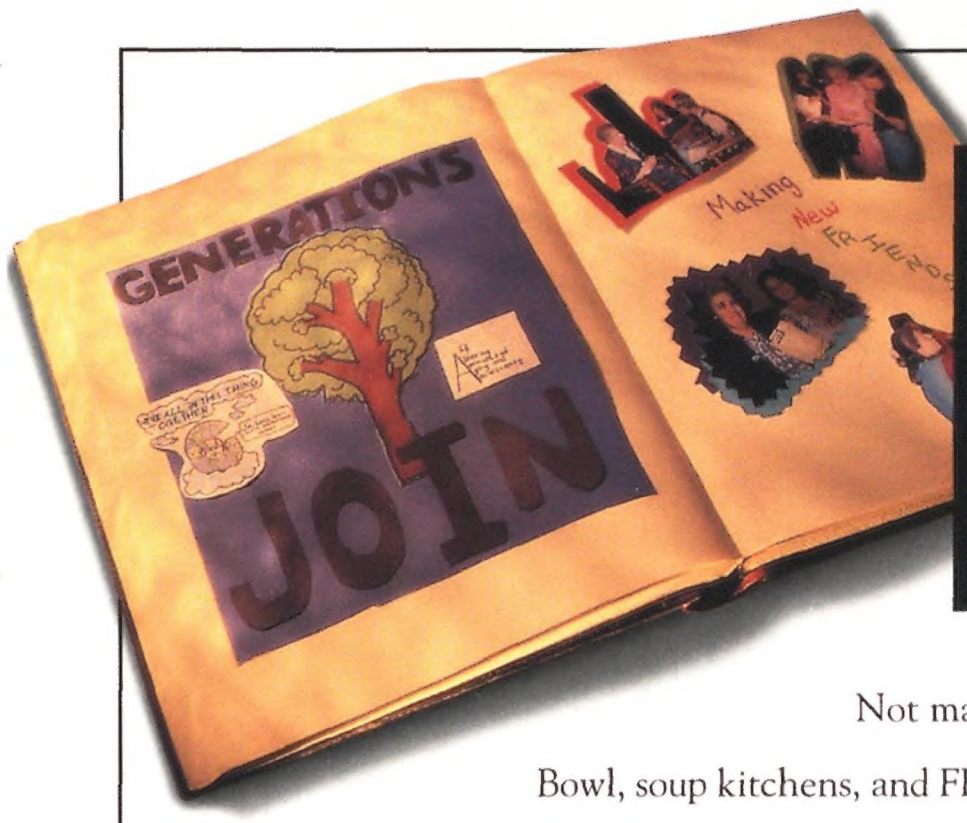
In the bathroom, white tiles ran up the walls. There was no box of loose powder for the unfortunate guest who'd left her compact at home. The reading matter was *The History of Byzantine Civilization.* I pulled out the bookmark and inserted it in a later chapter.

The kitchen was unmodern. The housemaid was reading a newspaper. On the table rested a silver tray: *Would she soon fill it with giant brownies?*

I visited the dining room last. The table had a lace runner, with fringe. I felt positive that there were bedrooms on the third floor. I felt pretty sure that my hosts slept in them. But I couldn't help imagining them asleep here, on the dining table. Their long forms would be covered with the lace cloth.

We stood up to leave ten minutes after the last cucumber sandwich. My parents thanked the Cunninghams with enthusiasm that sounded like relief. In the car they giggled a lot at nothing in particular. I read street signs. Adams. Hartley. Washington. Fuller. . . Suddenly I remembered that streets honored great men, and that three of those great men were the forebears of the Cunningham children. Hartley, Fuller and Hale hadn't been named after streets—it was the other way around! I laughed out loud.

Perhaps the Cunninghams were relaxing by now, too. Mrs. Cunningham would take off her laced shoes. Dr. Cunningham would discard his own Oxfords. They'd move their chairs close together. His feet would rub hers in front of the fire. And maybe later they'd cut pages out of *The History of Byzantine Civilization* (surely it was just for show) and make paper airplanes to throw at the Ancestor.



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Not many 6th graders go around reminiscing about the Dust Bowl, soup kitchens, and FDR's fireside chats. For children of that age usually just talk about the things their friends talk about. But, what makes Pamela Schmidt's Shreveport, Louisiana 6th graders so different is that their friends are senior citizens. And their unique relationship began as part of a program Pamela initiated called A^4 = Altering Attitudes of Aging and Adolescence.

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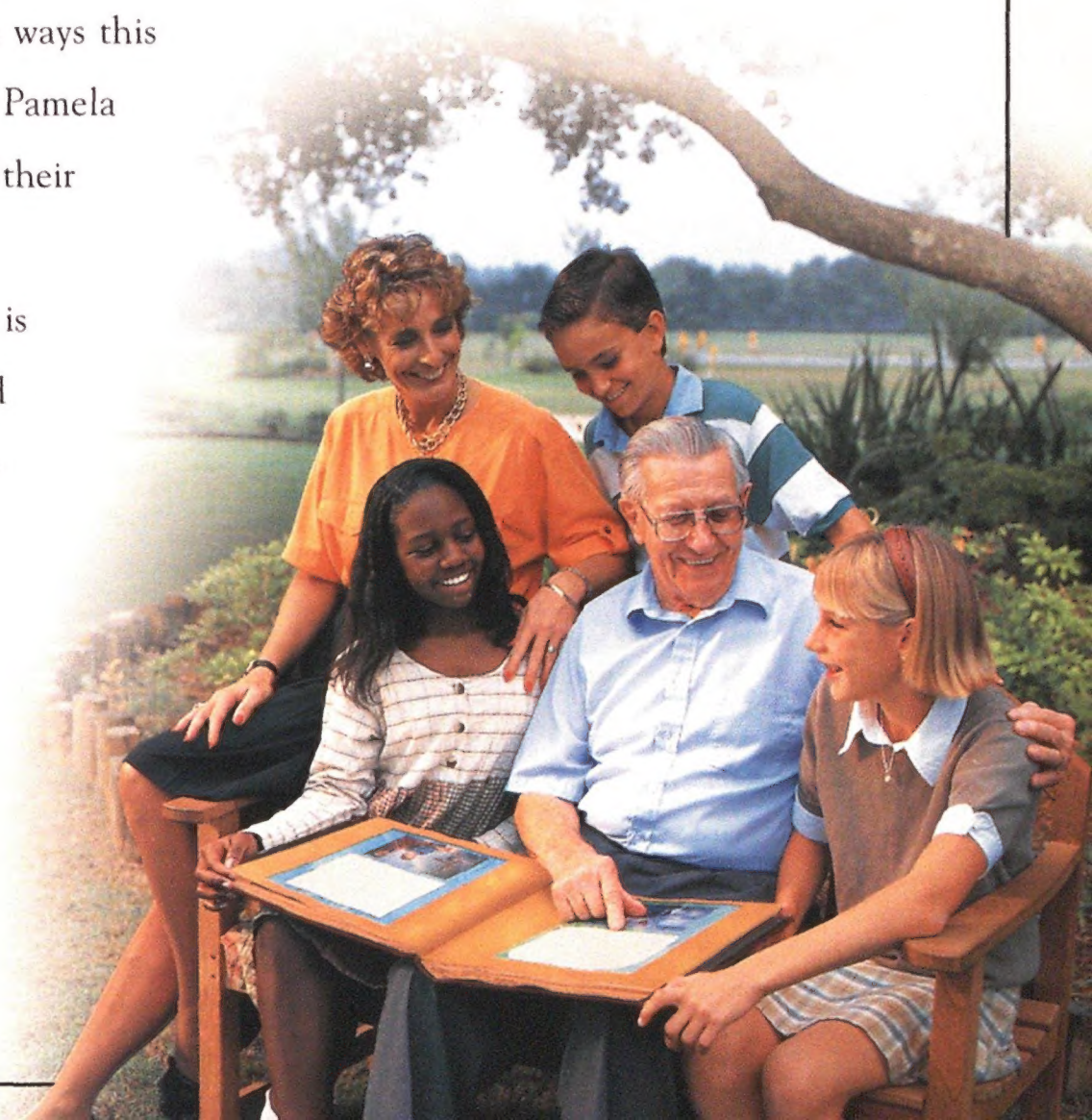

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